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# 44%

## *of all* METAL WORKING EQUIPMENT *is at least*

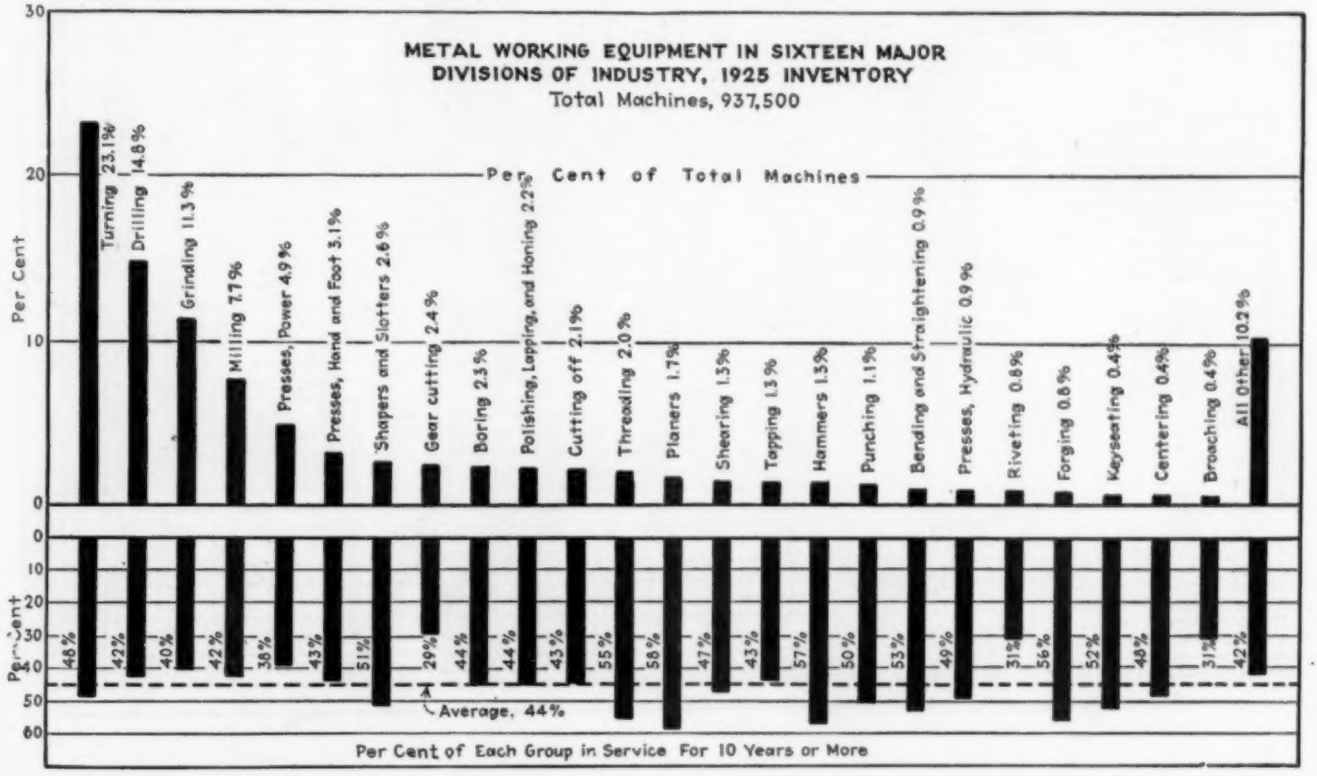
# Ten Years Old

By W. E. Irish

*Associate Editor, American Machinist*

THERE are approximately 937,500 metal working machines in 16 main production divisions of the metal working industry. This total is estimated to represent something in excess of 75 per cent of all the metal working equipment. The estimate is based on two facts: First, the divisions surveyed accounted in 1923 for approximately 71 per cent of the $15,890,000,000 in total metal product value. Second, the product value is comparatively high as compared to metal working equipment in service in the divisions not included. There are probably in the neighborhood of 1,200,000 metal working machines in all branches of the industry.

This summary serves to bring together the individual equipment counts published in the *American Machinist* during the past few months. It analyzes the types of machines by per cent of the total in use in the 16 com-



# METAL WORKING MACHINERY INVENTORIES IN CERTAIN DIVISIONS OF INDUSTRY

Equipment Counts Resulting from a Study made by the -AMERICAN MACHINIST- in Sixteen U.S. Census Production Divisions in the Metal Working Field —

| Kind of Machine Tool | MACHINERY EQUIPMENT PARTS AND JOB SHOPS | | | | | | | | AUTOMOTIVE & TRANSPORTATION | | | | IRON & STEEL PRODUCTS | | | | TOTALS FOR THE DIVISIONS SHOWN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Agricultural Machinery and Parts | Cash Registers and Calculating Machines | Electrical Machinery, Apparatus and Supplies | Engines, Steam, Oil, Gas and Warterwheels | Pumps and Pumping Machinery | Textile Machinery and Parts | Typewriters | Other Machinery Parts and Job Shops | Motor Vehicles | Motor Vehicle Parts and Vehicle Bodies | Cars, Steam and Electric, Railroad | Class A Steam R.R. Repair Shops | Bolts, Nuts, Rivets and Washers | Screw Machine Products | Steam Fitting, Valves and Water Heating App. | Edge Tools, Cutlery and Hand Tools | |
| | TOTAL MACHINES IN SERVICE, JAN. 1, 1926 | | | | | | | | | | | | | | | | |
| Engine Lathes | 1883 | 154 | 8110 | 3078 | 1281 | 4769 | 305 | 31400 | 9151 | 7765 | 1615 | 9940 | 516 | 238 | 1442 | 4160 | 86,407 |
| Hand Turret Lathes | 120 | 58 | 1323 | 220 | 336 | 771 | 12 | 3285 | 5570 | 2290 | 119 | 549 | 22 | 0 | 2155 | 552 | 15,382 |
| Power Turret Lathes | 931 | 20 | 1950 | 1358 | 432 | 998 | 21 | 8524 | 4210 | 4445 | 357 | 1591 | 58 | 25 | 889 | 665 | 26,474 |
| Semi-Automatic Lathes | 33 | 13 | 1362 | 508 | 84 | 78 | 0 | 815 | 1610 | 3660 | 85 | 137 | 15 | 0 | 39 | 190 | 8,629 |
| Hand Screw Machines | 117 | 266 | 1135 | 385 | 138 | 396 | 219 | 4040 | 1419 | 1408 | 17 | 36 | 44 | 288 | 502 | 652 | 11,061 |
| Automatic Screw Machines, Single Spindle | 219 | 1246 | 2495 | 1190 | 90 | 881 | 1012 | 2835 | 2865 | 2160 | 170 | 23 | 218 | 1481 | 417 | 976 | 18,278 |
| Automatic Screw Machines, Multiple Spindle | 66 | 130 | 1192 | 773 | 84 | 246 | 77 | 1971 | 2142 | 631 | 0 | 41 | 167 | 643 | 324 | 811 | 9,198 |
| Chucking Lathes | 26 | 0 | 687 | 275 | 102 | 389 | 30 | 1023 | 2700 | 1495 | 51 | 95 | 58 | 10 | 170 | 190 | 7,301 |
| Multiple Spindle Chucking Machines, Rotary Work | 0 | 0 | 81 | 44 | 15 | 156 | 0 | 24 | 251 | 416 | 0 | 5 | 0 | 51 | 64 | 19 | 1,122 |
| Multiple Spindle Chucking Machines, Rotary Tools | 0 | 0 | 14 | 4 | 15 | 13 | 0 | 118 | 0 | 71 | 0 | 0 | 0 | 0 | 70 | 0 | 305 |
| Speed Lathes | 110 | 96 | 1248 | 264 | 45 | 1153 | 228 | 2621 | 1662 | 566 | 68 | 285 | 116 | 142 | 518 | 733 | 9,875 |
| Bench Lathes | 37 | 448 | 3045 | 48 | 39 | 78 | 391 | 1995 | 259 | 867 | 0 | 85 | 0 | 182 | 224 | 710 | 8,408 |
| Tool Room Lathes | 178 | 287 | 408 | 326 | 120 | 272 | 56 | 3114 | 1068 | 1531 | 357 | 460 | 145 | 243 | 386 | 1132 | 10,083 |
| Wheel Lathes | 4 | 0 | 9 | 15 | 9 | 58 | 0 | 129 | 412 | 9 | 51 | 1220 | 0 | 0 | 0 | 0 | 1,916 |
| Axle Lathes | 33 | 0 | 32 | 0 | 0 | 13 | 0 | 201 | 46 | 177 | 204 | 750 | 0 | 0 | 0 | 0 | 1,466 |
| Forge Lathes | 0 | 0 | 5 | 11 | 0 | 6 | 0 | 35 | 53 | 0 | 0 | 23 | 0 | 0 | 0 | 13 | 146 |
| Hand Milling Machines | 106 | 366 | 1374 | 454 | 42 | 246 | 417 | 1900 | 2691 | 1673 | 119 | 0 | 73 | 212 | 317 | 862 | 10,852 |
| Bench Milling Machines | 4 | 39 | 265 | 8 | 3 | 91 | 77 | 283 | 15 | 115 | 0 | 32 | 0 | 51 | 15 | 139 | 1,137 |
| Plain (Knee and Column Type) Milling Machines | 376 | 796 | 2723 | 1095 | 219 | 1756 | 577 | 7670 | 4709 | 2760 | 408 | 386 | 211 | 162 | 332 | 2235 | 26,414 |
| Universal (Knee and Column Type) Mill. Mach. | 214 | 158 | 1556 | 304 | 153 | 654 | 89 | 3979 | 2135 | 1912 | 272 | 518 | 65 | 91 | 270 | 1284 | 13,653 |
| Vertical (Knee and Column Type) Mill. Mach. | 120 | 61 | 1323 | 484 | 21 | 305 | 47 | 2728 | 1289 | 372 | 85 | 136 | 15 | 15 | 39 | 383 | 7,623 |
| Lincoln Type Manufacturing Milling Machines | 69 | 107 | 51 | 52 | 15 | 220 | 104 | 1321 | 747 | 691 | 68 | 0 | 0 | 0 | 93 | 1372 | 4,910 |
| Semi-Automatic Type Milling Machines | 7 | 95 | 247 | 231 | 21 | 180 | 196 | 567 | 886 | 407 | 0 | 5 | 7 | 10 | 46 | 411 | 3,315 |
| Continuous Mill. Mach. Rotary or Drum Type | 4 | 7 | 147 | 326 | 3 | 45 | 0 | 106 | 274 | 133 | 0 | 0 | 22 | 30 | 8 | 51 | 1,156 |
| Planer Type Milling Machines | 84 | 0 | 334 | 129 | 48 | 253 | 0 | 921 | 450 | 116 | 136 | 132 | 0 | 0 | 8 | 96 | 2,706 |
| Gear Cutting Machines, Rotary or Milling Type | 164 | 121 | 325 | 70 | 54 | 648 | 68 | 2691 | 2080 | 2210 | 68 | 13 | 15 | 30 | 8 | 304 | 8,869 |
| Gear Cutting Machines, Hobbing Type | 175 | 61 | 202 | 451 | 69 | 259 | 9 | 1652 | 1592 | 1362 | 34 | 0 | 0 | 20 | 0 | 139 | 6,025 |
| Gear Cutting Machines, Planing or Shaping Type | 37 | 7 | 60 | 44 | 39 | 32 | 3 | 2112 | 1760 | 3125 | 0 | 5 | 0 | 0 | 8 | 202 | 7,434 |
| Vertical Boring Mills | 325 | 4 | 1785 | 948 | 201 | 240 | 9 | 4549 | 1059 | 814 | 459 | 2460 | 0 | 10 | 270 | 228 | 13,361 |
| Horizontal Boring Machines | 237 | 2 | 963 | 798 | 186 | 84 | 0 | 3351 | 998 | 673 | 153 | 545 | 29 | 20 | 15 | 209 | 8,263 |
| Radial Drilling Machines | 931 | 18 | 2380 | 1091 | 366 | 233 | 6 | 8290 | 2379 | 698 | 629 | 2090 | 160 | 51 | 247 | 411 | 19,980 |
| Upright Drilling Machines, One Spindle | 1938 | 269 | 4150 | 2120 | 735 | 2513 | 758 | 15160 | 12710 | 9875 | 1921 | 3790 | 327 | 152 | 1399 | 2690 | 60,307 |
| Upright Drilling Machines, Two or More Spindles | 460 | 417 | 1778 | 959 | 276 | 881 | 823 | 4000 | 3562 | 3000 | 357 | 225 | 65 | 40 | 487 | 1000 | 18,330 |
| Upright Drilling Machines, Two or More Heads | 65 | 26 | 169 | 231 | 39 | 175 | 0 | 531 | 870 | 637 | 323 | 85 | 15 | 10 | 108 | 215 | 3,489 |
| Sensitive Drilling Machines, One Spindle | 361 | 660 | 3178 | 407 | 189 | 713 | 121 | 6196 | 6135 | 3416 | 374 | 1020 | 203 | 400 | 356 | 894 | 22,621 |
| Sensitive Drilling Machines, Two or More Spindles | 69 | 670 | 2682 | 99 | 120 | 622 | 86 | 1960 | 2289 | 1328 | 136 | 103 | 0 | 147 | 201 | 152 | 10,664 |
| Sensitive Drilling Machines, Two or More Heads | 11 | 0 | 83 | 63 | 6 | 0 | 0 | 106 | 1022 | 389 | 0 | 72 | 0 | 0 | 31 | 25 | 1,808 |
| Two-, Three- and Four-way Drilling Machines | 18 | 2 | 23 | 352 | 18 | 318 | 0 | 224 | 198 | 425 | 0 | 75 | 7 | 0 | 62 | 32 | 1,754 |
| Tapping Machines, Single | 120 | 208 | 1885 | 402 | 90 | 181 | 356 | 1345 | 1251 | 1327 | 85 | 68 | 1880 | 126 | 294 | 506 | 10,123 |
| Tapping Machines, Multiple | 77 | 9 | 151 | 66 | 0 | 13 | 15 | 448 | 137 | 150 | 51 | 186 | 683 | 10 | 255 | 38 | 2,289 |
| Pipe Threading and Cutting Machines | 128 | 11 | 328 | 110 | 123 | 52 | 9 | 1700 | 212 | 88 | 306 | 1330 | 16 | 10 | 263 | 158 | 4,843 |
| Bolt Threading and Cutting Machines | 343 | 2 | 119 | 249 | 69 | 39 | 3 | 1429 | 381 | 407 | 629 | 2780 | 2432 | 30 | 64 | 323 | 9,289 |
| Thread Chasing Machines | 4 | 0 | 73 | 4 | 24 | 45 | 0 | 307 | 114 | 204 | 0 | 64 | 102 | 31 | 155 | 202 | 1,329 |
| Thread Hobbing Machines | 0 | 0 | 27 | 0 | 0 | 0 | 9 | 71 | 99 | 124 | 17 | 0 | 7 | 0 | 0 | 44 | 398 |
| Thread Milling Machines | 4 | 4 | 87 | 55 | 6 | 32 | 0 | 437 | 381 | 301 | 34 | 13 | 87 | 0 | 15 | 120 | 1,576 |
| Thread Rolling Machines | 4 | 7 | 339 | 0 | 0 | 0 | 21 | 224 | 0 | 9 | 11 | 0 | 880 | 101 | 8 | 6 | 1,616 |
| Planers | 281 | 25 | 1140 | 330 | 156 | 577 | 33 | 6600 | 322 | 628 | 527 | 2521 | 138 | 40 | 193 | 658 | 14,169 |
| Open-side Planers | 7 | 2 | 106 | 19 | 9 | 0 | 3 | 631 | 15 | 44 | 136 | 319 | 7 | 5 | 100 | 38 | 1,647 |
| Shapers | 372 | 70 | 2777 | 425 | 159 | 240 | 121 | 5751 | 1159 | 1619 | 765 | 2790 | 167 | 142 | 309 | 1631 | 18,497 |
| Vertical Shapers | 7 | 5 | 389 | 22 | 3 | 0 | 12 | 236 | 63 | 18 | 17 | 240 | 15 | 5 | 8 | 96 | 1,126 |
| Slotters | 36 | 16 | 697 | 59 | 12 | 356 | 86 | 1005 | 114 | 265 | 238 | 816 | 412 | 21 | 8 | 174 | 4,375 |
| Broaching Machines | 131 | 7 | 183 | 121 | 42 | 91 | 9 | 802 | 954 | 885 | 17 | 68 | 7 | 21 | 8 | 304 | 3,650 |
| Keyseating Machines | 190 | 2 | 312 | 194 | 72 | 59 | 3 | 2326 | 130 | 212 | 136 | 100 | 15 | 6 | 39 | 133 | 3,929 |
| Centering Machines | 88 | 7 | 278 | 161 | 36 | 143 | 6 | 1096 | 450 | 540 | 85 | 496 | 29 | 5 | 15 | 260 | 3,695 |
| Grinding Machines, Plain Cylindrical | 398 | 72 | 1108 | 1446 | 96 | 447 | 21 | 2539 | 3305 | 2565 | 34 | 318 | 94 | 40 | 85 | 633 | 13,201 |
| Grinding Machines, Universal Cylindrical | 157 | 46 | 812 | 209 | 81 | 136 | 110 | 1748 | 1457 | 1212 | 136 | 324 | 36 | 35 | 77 | 570 | 7,146 |
| Grinding Machines, Surface, Reciprocating | 47 | 110 | 1305 | 198 | 45 | 201 | 219 | 1948 | 718 | 858 | 51 | 238 | 116 | 56 | 54 | 766 | 7,010 |
| Grinding Machines, Surface Rotating | 73 | 18 | 362 | 341 | 27 | 117 | 3 | 838 | 633 | 1035 | 68 | 186 | 15 | 5 | 39 | 481 | 4,241 |
| Grinding Machines, Internal | 73 | 16 | 288 | 180 | 39 | 78 | 0 | 981 | 2210 | 3132 | 17 | 239 | 0 | 5 | 0 | 307 | 7,765 |
| Grinding Machines, Cylinder | 22 | 7 | 330 | 198 | 15 | 91 | 0 | 431 | 763 | 1122 | 34 | 72 | 0 | 0 | 8 | 96 | 3,201 |
| Grinding Machines, Cutter | 164 | 130 | 884 | 989 | 105 | 324 | 71 | 3059 | 2165 | 1282 | 170 | 562 | 116 | 56 | 100 | 1176 | 11,353 |

# METAL WORKING MACHINERY INVENTORIES IN CERTAIN DIVISIONS OF INDUSTRY

Equipment Counts Resulting from a Study made by the -AMERICAN MACHINIST- in Sixteen U. S. Census Production Divisions in the Metal Working Field —

| Kind of Machine | MACHINERY EQUIPMENT PARTS AND JOB SHOPS | | | | | | | | AUTOMOBILE & TRANSPORTATION | | | | IRON & STEEL PRODUCTS | | | | TOTALS FOR THE DIVISIONS SHOWN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Agricultural Machinery and Parts | Cash Registers and Calculating Machines | Electrical Machinery, Apparatus and Supplies | Engines, Steam, Oil, Gas and Waterwheels | Pumps and Pumping Machinery | Textile Machinery and Parts | Typewriters | Other Machinery Parts and Job Shops | Motor Vehicles | Motor Vehicle Parts and Vehicle Bodies | Cars, Steam and Electric, Railroad | Class A Steam R.R. Repair Shops | Bolts, Nuts, Rivets and Washers | Screw Machine Products | Steam Fitting, Valves and Water Heating Apps | Edge Tools, Cutlery and Hand Tools | |
| | TOTAL MACHINES IN SERVICE, JAN. 1, 1926 | | | | | | | | | | | | | | | | |
| Grinding Machines, Floor, No Feed Attachments | 971 | 364 | 4420 | 721 | 426 | 1413 | 83 | 7110 | 4189 | 2725 | 1360 | 5278 | 283 | 228 | 433 | 2190 | 32,794 |
| Grinding Machines, Bench, No Feed Attachments | 190 | 110 | 408 | 81 | 135 | 285 | 626 | 1215 | 290 | 460 | 136 | 342 | 225 | 253 | 301 | 804 | 5,860 |
| Grinding Machines, Disk | 124 | 61 | 866 | 271 | 78 | 161 | 110 | 1912 | 809 | 1009 | 221 | 231 | 44 | 40 | 247 | 424 | 6,608 |
| Grinding Machines, Belt | 40 | 12 | 261 | 66 | 9 | 68 | 9 | 779 | 1098 | 991 | 17 | 210 | 94 | 6 | 100 | 1265 | 5,014 |
| Grinding Machines, Centerless | 0 | 23 | 0 | 96 | 6 | 32 | 3 | 236 | 321 | 442 | 85 | 0 | 0 | 25 | 31 | 96 | 1,396 |
| Polishing and Buffing Machines, Wheel | 456 | 191 | 1264 | 132 | 48 | 395 | 488 | 2831 | 2974 | 3210 | 102 | 150 | 7 | 253 | 827 | 3064 | 16,388 |
| Polishing and Buffing Machines, Belt | 161 | 18 | 64 | 104 | 9 | 62 | 0 | 259 | 267 | 248 | 17 | 77 | 0 | 5 | 216 | 348 | 1,845 |
| Polishing and Buffing Machines, Semi-Automatic | 7 | 2 | 114 | 11 | 0 | 46 | 0 | 35 | 0 | 88 | 0 | 5 | 0 | 15 | 178 | 190 | 696 |
| Lapping Machines | 0 | 82 | 18 | 92 | 3 | 13 | 3 | 25 | 259 | 708 | 0 | 23 | 0 | 0 | 39 | 196 | 1,461 |
| Honing Machines | 0 | 0 | 0 | 11 | 0 | 0 | 38 | 0 | 198 | 9 | 0 | 0 | 0 | 0 | 0 | 38 | 294 |
| Cutting-Off Machines, Parting Tool Type | 40 | 0 | 50 | 4 | 33 | 97 | 41 | 401 | 30 | 97 | 68 | 41 | 0 | 0 | 46 | 19 | 967 |
| Cutting-Off Machines, Power Hack Saw Type | 241 | 28 | 1287 | 279 | 123 | 279 | 41 | 5092 | 840 | 1025 | 680 | 665 | 116 | 101 | 278 | 982 | 12,057 |
| Cutting-Off Machines, Rotary Cold Saw Type | 91 | 19 | 890 | 104 | 30 | 110 | 15 | 1286 | 366 | 319 | 187 | 351 | 29 | 10 | 77 | 298 | 4,182 |
| Cutting-Off Machines, Band Saw Type | 22 | 14 | 537 | 66 | 27 | 58 | 44 | 519 | 212 | 336 | 51 | 72 | 7 | 5 | 93 | 183 | 2,246 |
| Cutting-Off Machines, Friction or Hot Saw | 7 | 0 | 14 | 8 | 6 | 13 | 0 | 177 | 46 | 27 | 68 | 209 | 0 | 0 | 0 | 26 | 600 |
| Shears, Knife | 210 | 41 | 1688 | 81 | 69 | 207 | 9 | 2242 | 549 | 549 | 697 | 812 | 290 | 26 | 155 | 582 | 8,172 |
| Shears, Rotary | 99 | 7 | 380 | 19 | 27 | 19 | 0 | 1006 | 274 | 283 | 109 | 230 | 94 | 0 | 23 | 44 | 2,613 |
| Shears, Slitting | 77 | 14 | 320 | 15 | 3 | 13 | 41 | 591 | 107 | 62 | 102 | 212 | 7 | 36 | 0 | 51 | 1,651 |
| Nibbling Machines | 15 | 18 | 105 | 15 | 15 | 45 | 6 | 331 | 183 | 53 | 0 | 68 | 0 | 15 | 16 | 25 | 909 |
| Hammers, Steam | 77 | 2 | 151 | 114 | 18 | 6 | 3 | 874 | 306 | 613 | 459 | 1760 | 7 | 5 | 0 | 462 | 4,746 |
| Hammers, Pneumatic (not portable) | 29 | 0 | 50 | 11 | 3 | 6 | 0 | 472 | 69 | 36 | 86 | 185 | 22 | 0 | 23 | 32 | 1,022 |
| Hammers, Drop | 318 | 16 | 234 | 63 | 12 | 39 | 65 | 673 | 137 | 265 | 102 | 57 | 36 | 10 | 86 | 1466 | 3,567 |
| Hammers, Helve | 139 | 2 | 23 | 22 | 21 | 39 | 110 | 272 | 122 | 36 | 153 | 236 | 15 | 6 | 0 | 430 | 1,624 |
| Hammers, Spring | 77 | 7 | 5 | 15 | 6 | 32 | 62 | 283 | 99 | 266 | 34 | 108 | 7 | 5 | 23 | 364 | 1,382 |
| Riveting Machines, Pneumatic | 113 | 4 | 147 | 19 | 6 | 0 | 0 | 1287 | 267 | 469 | 306 | 430 | 0 | 0 | 0 | 82 | 3,130 |
| Riveting Machines, Hydraulic | 33 | 0 | 5 | 0 | 0 | 0 | 0 | 47 | 16 | 0 | 17 | 45 | 0 | 0 | 0 | 19 | 182 |
| Riveting Machines, Steam | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Riveting Machines, Power | 277 | 285 | 628 | 15 | 12 | 84 | 166 | 1463 | 168 | 806 | 17 | 15 | 15 | 26 | 124 | 316 | 4,417 |
| Forging Machines, Hot, Bulldozers | 301 | 0 | 56 | 19 | 12 | 0 | 0 | 461 | 46 | 115 | 476 | 481 | 7 | 0 | 8 | 82 | 2,063 |
| Forging Machines, Hot, Forging Machines | 177 | 0 | 87 | 33 | 12 | 39 | 0 | 224 | 99 | 203 | 238 | 624 | 785 | 0 | 15 | 171 | 2,707 |
| Forging Machines, Cold Headers, Bolt, Nut, etc. | 22 | 7 | 362 | 0 | 0 | 0 | 24 | 48 | 8 | 0 | 51 | 156 | 1451 | 5 | 8 | 0 | 2,142 |
| Forging Machines, Cold, Swaging | 7 | 0 | 142 | 0 | 0 | 0 | 9 | 59 | 15 | 80 | 0 | 39 | 312 | 0 | 8 | 19 | 690 |
| Bending Brakes | 131 | 23 | 339 | 22 | 39 | 84 | 6 | 1157 | 404 | 177 | 187 | 284 | 0 | 0 | 77 | 171 | 3,101 |
| Bending Rolls, Horizontal | 219 | 9 | 463 | 52 | 60 | 39 | 15 | 1665 | 221 | 106 | 136 | 822 | 7 | 31 | 85 | 63 | 3,993 |
| Bending Rolls, Vertical | 11 | 0 | 9 | 0 | 0 | 0 | 0 | 59 | 15 | 27 | 34 | 85 | 0 | 0 | 31 | 0 | 271 |
| Straightening Rolls | 18 | 4 | 156 | 4 | 3 | 58 | 3 | 248 | 61 | 18 | 51 | 146 | 87 | 20 | 23 | 430 | 1,336 |
| Punching Machines | 376 | 2 | 575 | 81 | 54 | 26 | 9 | 2400 | 84 | 549 | 833 | 737 | 269 | 11 | 155 | 164 | 6,325 |
| Combined Punches and Shears | 230 | 0 | 69 | 33 | 18 | 13 | 0 | 1782 | 137 | 71 | 493 | 1326 | 1 | 0 | 54 | 106 | 4,340 |
| Presses, Hand, Arbor | 318 | 95 | 2780 | 692 | 195 | 551 | 92 | 6990 | 4236 | 1869 | 221 | 361 | 73 | 142 | 348 | 1246 | 19,208 |
| Presses, Hand, Light Punch Press Work | 11 | 7 | 440 | 8 | 6 | 306 | 0 | 389 | 297 | 27 | 238 | 90 | 218 | 46 | 46 | 323 | 2,451 |
| Presses, Foot, Light Punch Press Work | 172 | 35 | 926 | 42 | 6 | 220 | 225 | 1146 | 724 | 1576 | 34 | 13 | 22 | 861 | 317 | 503 | 6,810 |
| Presses, Power, Crank Type | 730 | 684 | 9187 | 199 | 84 | 434 | 873 | 9160 | 2128 | 7349 | 527 | 153 | 247 | 625 | 464 | 1228 | 34,060 |
| Presses, Power, Toggle Type | 41 | 23 | 284 | 11 | 6 | 6 | 27 | 448 | 114 | 364 | 136 | 14 | 0 | 20 | 85 | 57 | 1,632 |
| Presses, Power, Double-Acting Type | 15 | 18 | 156 | 0 | 0 | 6 | 21 | 153 | 38 | 159 | 0 | 14 | 0 | 24 | 62 | 38 | 704 |
| Presses, Power, Dieing Type | 7 | 2 | 348 | 14 | 9 | 0 | 3 | 153 | 61 | 97 | 0 | 0 | 0 | 0 | 46 | 342 | 1,082 |
| Presses, Power Automatic | 11 | 5 | 87 | 4 | 0 | 58 | 3 | 153 | 15 | 186 | 170 | 5 | 80 | 66 | 15 | 51 | 909 |
| Presses, Power, Trimming Presses | 33 | 4 | 334 | 224 | 3 | 19 | 0 | 71 | 244 | 442 | 204 | 23 | 276 | 0 | 93 | 1480 | 3,450 |
| Presses, Power, Forcing, Arbor, Wheel | 29 | 4 | 440 | 11 | 3 | 45 | 21 | 283 | 1090 | 398 | 102 | 580 | 0 | 6 | 0 | 96 | 3,108 |
| Presses, Power, Baling | 0 | 2 | 92 | 8 | 0 | 0 | 3 | 48 | 69 | 35 | 0 | 9 | 0 | 10 | 15 | 13 | 304 |
| Presses, Hydraulic, Bending, Forming, Drawing | 26 | 12 | 1966 | 8 | 3 | 1 | 0 | 378 | 99 | 80 | 782 | 159 | 7 | 5 | 79 | 70 | 3,674 |
| Presses, Hydraulic, Forging | 0 | 0 | 9 | 4 | 3 | 0 | 3 | 24 | 8 | 80 | 119 | 41 | 0 | 0 | 0 | 6 | 297 |
| Presses, Hydraulic, Flanging | 15 | 0 | 0 | 0 | 6 | 0 | 0 | 94 | 0 | 9 | 0 | 59 | 0 | 0 | 8 | 13 | 204 |
| Presses, Hydraulic, Forcing, Wheel, etc. | 18 | 0 | 500 | 180 | 30 | 13 | 0 | 1027 | 305 | 168 | 85 | 1048 | 0 | 0 | 8 | 44 | 3,426 |
| Presses, Hydraulic, Baling | 0 | 0 | 46 | 0 | 0 | 0 | 3 | 36 | 23 | 71 | 0 | 5 | 0 | 0 | 0 | 0 | 184 |
| Presses, Hydraulic, Extruding | 0 | 0 | 32 | 0 | 3 | 0 | 0 | 24 | 0 | 9 | 0 | 704 | 7 | 0 | 0 | 6 | 785 |
| All other machines and miscellaneous | 412 | 561 | 47944 | 538 | 177 | 2974 | 696 | 8720 | 3540 | 11460 | 289 | 5650 | 1921 | 661 | 813 | 8775 | 95,203 |
| TOTALS | 19458 | 10206 | 144538 | 29615 | 8679 | 32164 | 10847 | 235796 | 126226 | 122290 | 22685 | 66380 | 16960 | 9099 | 19834 | 62758 | 937532 |

bined divisions. It points out certain high spots in the detailed counts themselves, and names certain limitations that should be observed in making use of the figures in any detailed analysis of one machine or group of machines. It also provides the counts of old equipment by divisions and shows a total of approximately 414,000 machines that have seen ten years or more of active service in the divisions studied. On the assumption that this age count will hold throughout the industry there is a probable old machine total of 530,000 units.

Due care should be exercised by manufacturers in picking specific classifications into which a given make of machine fits. This caution is given because of the lack of a well defined distinction between classifications evidenced on the questionnaire returns. Assume that a certain make of lathe is under consideration. The proper method to use in analyzing its range of possibilities in the industry is to pick out and add the counts in all classifications to which the lathe in question can be applied. The same holds true for milling machines, drills, grinders, threading machines, polishing machines, hammers; in fact for each of the groups where more than one make of machine serves a given purpose.

### Expansion Factor

The count is sufficiently accurate to serve for all practical purposes. On account of the necessity of using a factor for expansion from actual returns to totals, a certain degree of error is unavoidable. This error will be particularly evidenced in the counts that total less than 50 for a whole division. The reason is that a machine which does not normally serve in a given capacity is purchased or sold for the special purpose in a number of plants. The factor expands these applications where actual count might not show an equal number in use.

On the other hand the fact of a count below 50 does not exclude the possibility of very much more extended application by any means. Companies with a number of units may not have done this, yet. The machine may be new on the particular work in question and may have just started on its way to a more extended application. It is not difficult for anyone to name past cases of this nature. In fact several can be predicted for the future.

An important point that is brought out in the combined tabulations is the actual spread of machines that have ordinarily been considered as concentrated in given divisions. Screw machines in the turning group are a good example of the point. In the division of screw machine products there are all told approximately 2,400 units. These represent but a little more than 6 per cent of the total of the 38,500 in use in screw machine departments of other metal working divisions.

Tapping and bolt-threading machines form another example when their numbers in the bolt and nut division are compared with their totals in all the divisions combined. Thus in the bolt and nut division there are approximately 2,560 tapping machines and 2,430 bolt-threading machines as compared to totals of 12,400 and 9,300 in all of the divisions. This represents a use by the bolt and nut division of but 23 per cent of the total count of the combined types of equipment.

The extent of the press work in all branches of metal working is brought out by the individual and combined count of press equipment in the 16 divisions. Using the power crank type as the basis for comparison it is seen that the pump division is the only one in which fair quantities are not shown. The entire press group is a very important one in the list of metal-working equipment. Prediction is made that appreciable growth over present installations will come as the art of building up machine parts from plate and pressed shapes is developed by the leading manufacturers of arc and gas welding equipment. Definite progress is being made each day along these lines as opposed to the present use of castings.

There are numerous other points that can be brought out as the figures are interpreted from one angle or another. The type and numbers of machines in one industry as compared to those in another is one example. For the most part, however, analysis from one angle or another is of interest to but one manufacturer or to a small group at best. This article serves its purpose best, therefore, by furnishing the basic figures with which to work rather than to attempt the many individual studies of what they show.

There is one outstanding exception to this statement that is or should be of very particular interest to every manufacturer and user of metal working equipment. This exception is the use of old equipment in connection with tool making and maintenance.

The tabulations do not pointedly draw attention to the serious fact that a very large part of the old equipment is in the toolrooms and maintenance departments of the various divisions.

In toolrooms, with certain exceptions, the machines are not operated on a production basis. The fact that they do not have to be run at top speed often overshadows the fact that they are not by a wide margin as efficient nor even as accurate as the latest models. Many a toolroom machine is "babied" at a cost to the management that would be surprising were it but checked up.

And in the maintenance departments are to be found a big share of the "cast offs." Many long years of neglect and of actual failure of management to study the problems of the maintenance department have resulted in this condition. There is no neglect worse or no failure that is so productive of appreciable losses through overhead costs. A campaign on the part of the machinery users to throw out each piece of equipment that is in worse condition thar the machine it is repairing will make for maintenance improvement.

### Further Uses for Tabulations

The usefulness of the tabulations is not limited to a consideration of the machines listed by any means. Machines of a given class for example have the need for chucks, for toolholders, for wrenches, for lubricants, for grinding wheels. Each of the many items of tools, equipment and supplies, the need for which are dependent on the machines in service, can be set against the count for market analysis.

Machinery parts, gears, bearings, shafts, centers, castings, lubricators, clutches, motors, chains, couplings, etc., can be analyzed for markets in the metal working equipment division of the field.

The same holds true for materials of all descriptions entering into metal working machinery construction.

Contract markets for press tools are shown comparatively by checking the industries in which press work is a factor.

Doubtless other uses will be found for the counts as they are gone over by the many companies who with the builder of the metal working equipment help supply the field with its facilities.

# Locating the Stopping Points *of a* Precision Indexing Mechanism

The locating positions of the carrier having been established as closely as manufacturing positions will permit, they are now corrected by means of precision instruments

HARDENED steel lock-pins in the six radially disposed holes in the spindle carrier of the Mult-Au-Matic, determine the positions in which the carrier is stopped to allow the tools of each working station to perform their respective share of the work.

These holes, it will be remembered, extend through to the bore of the carrier, stopping at the bearing surface adjacent to the column. A single radially disposed hole in the wall of the column, at the same level as the holes in the carrier, is in line successively with the holes in the carrier as that member is indexed around the column. A mating lock-pin, which we will call the "bolt" to distinguish it from the others, slides in this hole in the column—being actuated by mechanism in the cored interior of the column—to engage each of the six lock-pins in turn. The inner ends of the six lock-pins which are flush with the bore of the carrier, are machined to the shape of a blunt wedge having an included angle of 15 deg. The outer end of the bolt in the column is machined to match this shape, and, as the indexing mechanism brings each lock-pin in turn before the bolt, the bolt moves out to engage it, thus fixing the position of the carrier. The location of the six radial holes in the carrier are determined—quite accurately, but not accurately enough—by the fixture on which that member is held in the boring machine. As the first step in the sequence of operations toward correcting such minor errors as may remain, six small pilot-holes are jig-drilled in the flange of the carrier in definite relation to the larger radial holes.

The lock-pins having been set in the carrier, and the bolt and a part of its actuating mechanism assembled into the column, these two members are brought together on the assembling floor, where special precision gaging disks are secured in the pilot-holes and the carrier is accurately divided, as has already been told. We now come to the problem of bringing the actual positions of the carrier, as established by the lock-pins, into coincidence with the provedly correct positions represented by the gaging disks. In Fig. 7 is shown the instrument employed to check the variations between the actual and the desired positions of the carrier. Secured in one of the slideways of the column is the bracket *H* that served in the operations described in the preceding article to hold the gaging devices, and which still serves that purpose here. It was put in place when the sequence of operations was started and is not disturbed until all the corrections have been made and the job has received the approval of the inspector. Clamped to the lower, horizontally projecting stud of the bracket *H* in this operation, is a device consisting of a light arm, *L*, pivoted upon an adjustable holder to swing freely in a horiozntal plane, and carrying at its free end a dial indicator. The holder is adjusted on the stud to bring the indicator level with the gaging disk *B* while the arm is tangent to the circle represented by the positions of the six disks on the carrier.

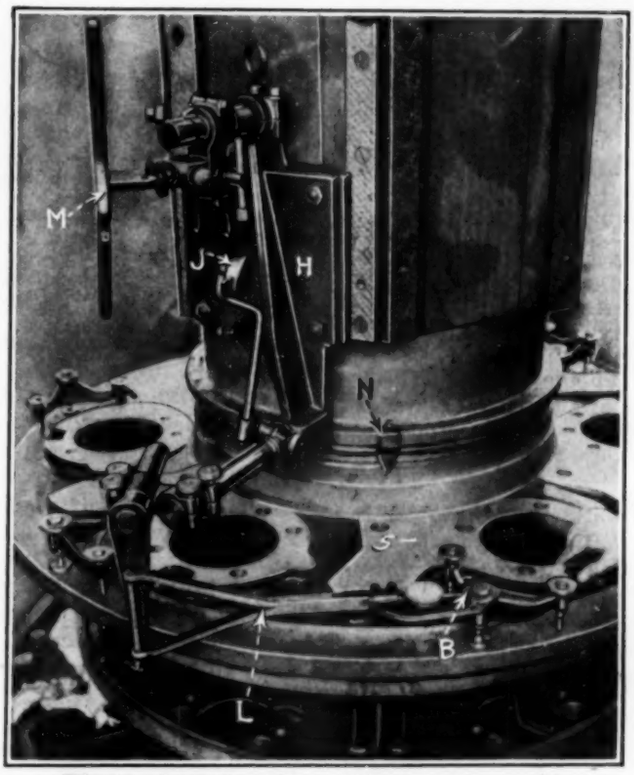



*Fig. 7—Checking the positions of the carrier with those of the gaging disks*

With the carrier locked by the bolt in a given position, the indicator is further adjusted so that as the operator swings the arm *L* to pass the button of the indicator back and forth over the periphery of the gaging disk, the pointer will rise to a maximum of zero at each pass. The holder is then clamped tightly to the stud and remains fixed throughout the operation.

The second and concluding article.

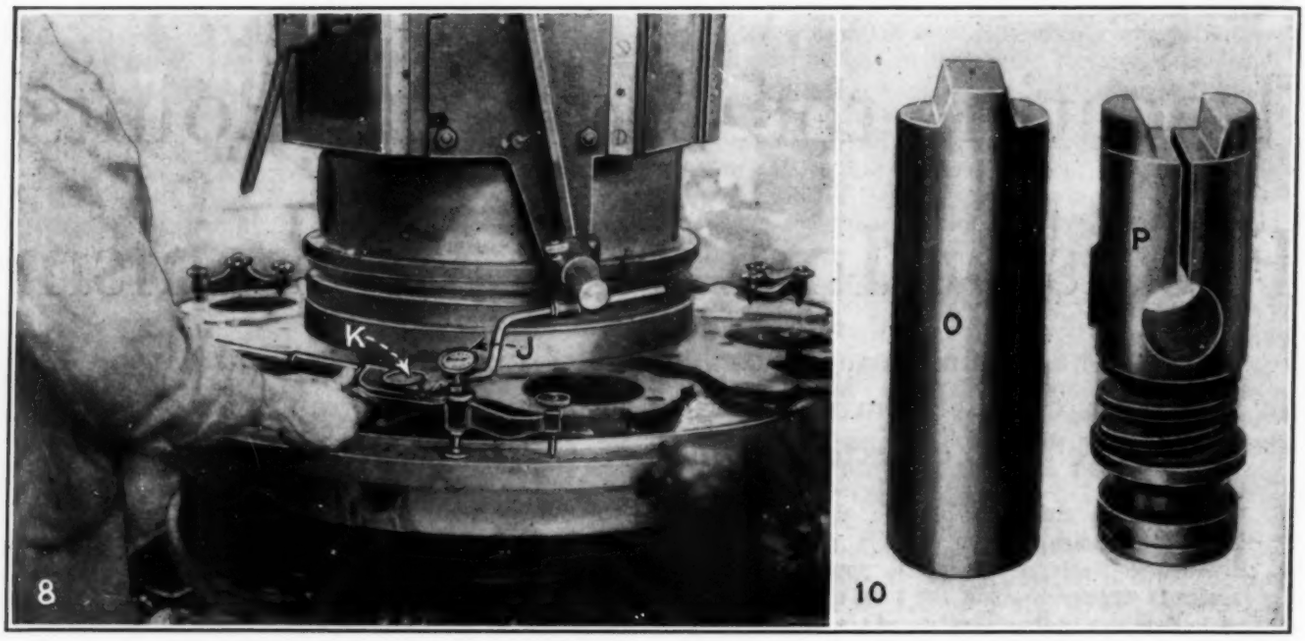



*Fig. 8—Re-application of the radial and chordal tests. Fig. 10—Lock-pin and bolt*

The locking bolt is now withdrawn by a movement of the temporary handle *M*, the carrier turned 60 deg. about its axis and locked in the next position. Upon passing the button of the indicator over the disk *B* at this station the reading would be the same as before if the position of the carrier were correct. The zero mark of the dial is chosen in this as in the other operations because it thus becomes a convenient point of departure from which plus and minus variations may be read directly in actual distances.

That there will be a deviation is a foregone conclusion, for the position of the carrier now depends upon the accuracy of several parts, all of which are produced by manufacturing methods, but the variation rarely exceeds one or two thousandths of an inch, measured, as will be observed, upon a circle that is upward of 18 ft. in circumference — a very creditable toolroom performance.

The temporary pointer *N* is attached to the column in a place convenient for observation and a chalk mark is made on the carrier adjacent to it while the carrier is still at first position. Its purpose is merely to aid the operator in keeping in mind the several stations as the work proceeds, for here, as elsewhere, it is his endeavor so to divide existing errors between the six stations as

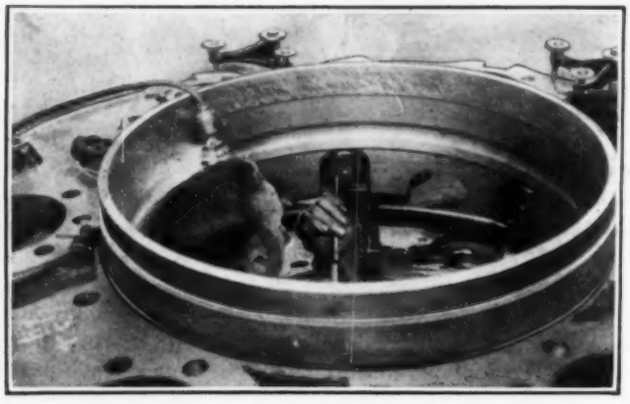


*Fig. 9—Correcting the error of the lock-pins*

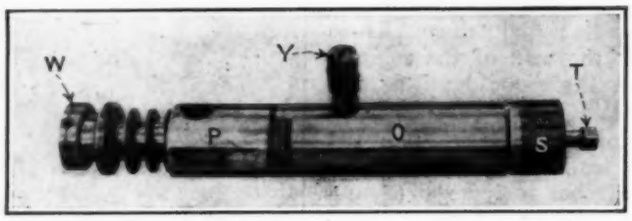



*Fig. 11—Lock-pin and bolt assembled with associated parts*

to cut down to a minimum the amount of actual corrective work to be done.

The six stations are tested successively and the amount each deviates from the correct position as represented by its respective gaging-disk, is chalked on the carrier. Thus the figure 5 followed by the minus sign, to be seen in this illustration, means that in making this first step the carrier has fallen five half-thousandths short of a full 60 deg. as measured over the circumference of the circle represented by the gaging-disks.

The several errors having been summed up and distributed—mathematically—between the six stations, the radial gage *J* is swung down to active position, as shown in Fig. 8, again to test the radius, and the chordal gage *K* is also applied to the gaging-disks; for the makers of the machine take no chances with temperature changes or with possible accidental displacements, however slight. When all checks have been made and the actual distances the carrier must be moved, as well as the direction of movement, is chalked on the surface at each station, the machine is again placed on the assembly frame, the ring-nut and ball bearing confining the column are removed, and the column is lifted out of the carrier.

In Fig. 9 may be seen the application of the actual corrective measures. The carrier is on the assembly frame with the workman beneath it, where he is scraping one of the angular faces of the lock-pin. Since this end of the pin occupies a position in a circle much smaller in diameter than that over which the measure-

ments were taken, the amount of metal to be removed from the pin is proportionately less than the measurement indicated by the chalked figure. The distance chalked on the carrier—modified by calculations—tells the workman how much stock is to come off, and the plus or minus hign following the figure indicates from which angular face of the pin it is to be removed.

The steel is hard and the work tedious, but fortunately there is but little of it to be done. Files, scrapers and oilstones are the tools used to accomplish the desired result. When the correction has been made on all of the pins the machine is reassembled and swung back to the floor, where all of the tests of Fig. 8 are again applied. Since no perceptible error is tolerated in the final result, these operations may have to be repeated several times before the much-to-be-desired "O.K., Johnson," to be seen in Fig. 6 of the preceding article, is chalked on the carrier.

Though the location of the lock-pins in the carrier and of the bolt in the column cannot be changed, a word about their construction and the manner of setting them in place may be in order.

In Fig. 10, *O* is the lock-pin and *P* the bolt. In Fig. 11 the several parts are laid in line in the positions occupied by them in the machine. The pin *O*, of which there are six, is a light drive fit in the radially disposed holes in the carrier, while the one bolt *P* is a sliding fit in a corresponding hole in the column.

After the pin O is driven, the threaded plug *S* is screwed into the tapped outer end of the hole to abut against the pin, and the capscrew *T*, which is threaded into the pin, is put through it. This provides a means of adjusting the pin radially, for it can be forced farther in by applying a spanner to the threaded plug, or it can be withdrawn by slacking off the plug and tightening the capscrew. When finally located, all parts are set up tightly and the setscrew *V* is put in the carrier

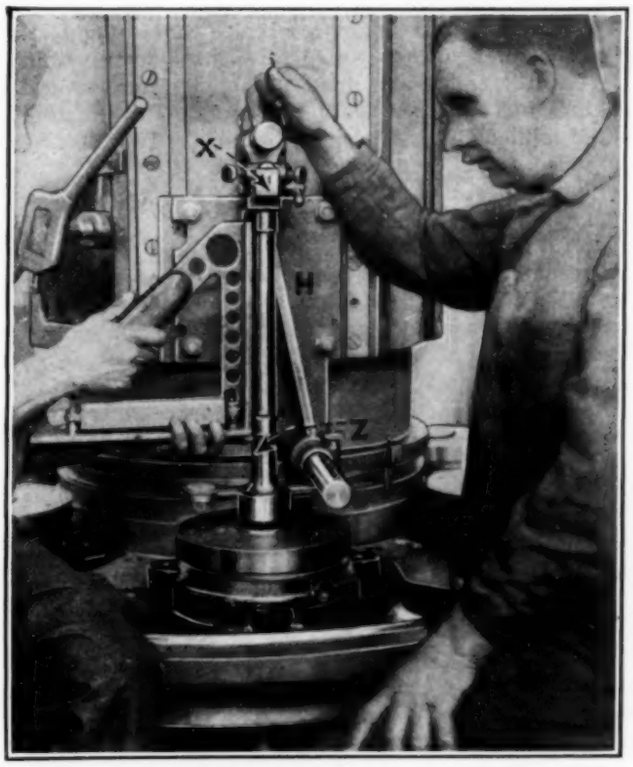



*Fig. 12—Setting the gage to test the spindles*

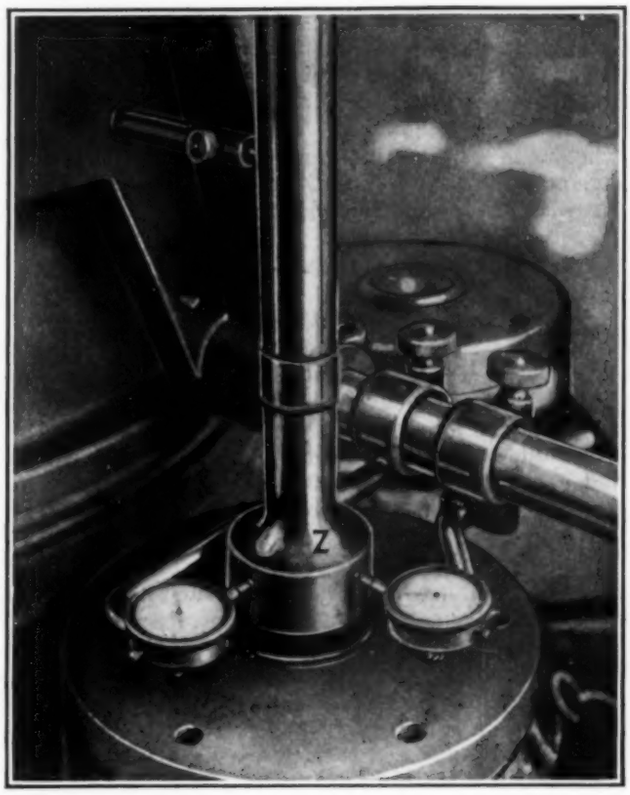



*Fig. 13—Application of the test*

to bear upon a flat that is milled or ground along one side of the pin to prevent it from turning on its axis.

The bolt is split over part of its length as shown, and is spring tempered. A Woodruff key holds the angular recess in alignment with the wedge-shaped ends of the lock-pin and the heavy coil spring behind it forces it to its seat. The lever by which the indexing mechanism actuates it is connected to the loose collar back of the spring, and the ringnut *W* stops the collar from coming off of the bolt. The withdrawal of the bolt is thus positive, while the seating upon the lockpin is brought about by the compression of the spring.

All of the foregoing work has been toward the exact indexing of the *carrier*. Since the final result to be attained is the exact indexing of the *spindles*, the foregoing operations may be regarded as but the means to an end; there still remains much to be done.

It was stated of the jig shown in Fig. 3 of the preceding article that it located many holes having to do with the placing of the work-spindles and their attached parts. The spindles, already assembled with their bearings in another department, are now set into the carrier and secured by capscrews passing through the flanges of the bearings into tapped holes in the respective flanges of the carrier. Three holes in the flange of each bearing are yet to be drilled and reamed in the carrier for dowels after the spindles have been located.

In Fig. 12 may be seen the bracket *H* that has been used to support most of the appliances employed in correcting the index. Its position in the slideway has not been changed during the foregoing operations, and here it is again requisitioned for a similar purpose, though in a different way.

Upon a short horizontally projecting stud near the top of the bracket is a holder *X* from which the bar *Z* depends. This bar is not only free to swing in all direc-

tions, but is also free to be lifted slightly by means of a cam lever in the holder. At the lower end of the bar is a small 60-deg. center point to match the center hole upon which the spindle was turned and ground. The spindles are not hollow.

The bar is set in position and its weight is allowed to rest upon the center point. The holder *X* is then adjusted to bring the bar vertical, the adjustment being checked by means of a square in the lower limb of which is a spirit level. Absolute exactness is not required for this adjustment.

Having brought the bar to a vertical plane as nearly as the means employed will permit, the two dial indicators to be seen in Fig. 13 attached to the lower stud of the bracket *H*, are brought to bear against the enlarged shoulder at the lower end of the bar *Z* at right angles to each other. The dials are set to read zero, the bar is lifted out of contact with the spindle, the carrier is indexed forward to the next station and the bar is lowered to rest upon the second spindle.

In this position both indicators should, of course, read zero, but as nothing has been done so far to correct the location of the spindle they merely show how far and in what direction it is out of place. The test is applied to all six spindles and the amount and direction of deviation noted in each case.

The error is usually very slight, since the holes in both bearing flange and carrier are jig drilled. As is usually the case when a joint is secured in this manner by capscrews, small errors may be corrected merely by rapping the flanges in the direction they should go. If the error is comparatively large it may be necessary to "draw" one or more of the screw holes with a file.

The concentricity of the center hole in the spindle is not taken for granted. Each time the indicators are applied to the bar the spindle is rotated, when error in this respect will be shown by the vibratory movement of the pointers. The dials are carefully adjusted so that the movement (if any) of each pointer carries it past the zero mark an equal amount in both directions, the zero marks then indicating the true center line in all cases, regardless of the amount of eccentricity of the center.

As in previous operations, this test is repeated many times, and not until the zero marks appear exactly midway of the range of vibration of both pointers, are the dowel holes drilled and reamed, and the dowels that finally secure the flanges driven home.

## What About the Family?

By Kendall Hereford

"FIRED John this morning after two warnings."

"What's the trouble?"

"He couldn't get the safety idea through his head, Chief. He nearly killed himself last month on that big grinder and when we were talking it came out that he had no insurance."

"But we have group insurance for all the men."

"I know that, but all the insurance and indemnity that we can give him won't keep his five children very long. He won't play safe. This morning he nearly hitched again and still had no insurance. It's being kind to his family to make that sink in. Likely as not if he did get caught sometime we would have to pay for the price of his carelessness."

## Infections from Cutting Oil

By E. G. Trott

THE frequency of illness and infections among men working with cutting oil has resulted in a thorough investigation and scientific research to determine the cause. Tests of the oil were made at all stages of processing, including new oil, reclaimed oil and oil in machines. Cultures were taken from wiping rags, used and newly purchased, and cultures from boils and pimples.

The oil in all the machines tested showed large quanties of pus-forming bacteria and other disease germs. The rags, purchased as sterile, were really filthy. The pus from infections and boils was found to contain the same family of bacteria as that which was found in the used oil.

The oil stream in even the most modern equipment is not protected against outside contamination. Foreign substances such as scraps of food, paper, and tobacco find their way into the oil stream, and germs from coughing, sneezing, spitting, and the millions of germs floating in the air, all contaminate the oil.

C. J. White states, "Machinists of all sorts have a common enemy in dirty oil which is rubbed into and absorbed by the follicles of the skin, and if boils don't follow, eczema may." Rosenburg, writing in the *New York Medical Journal and Medical Record*, October, 1922, states that, "it is a common thing to observe in those workers in or with oil a condition either of acne, dermatitis or furunculosis."

The ordinary preventive measures of filtering, centrifuging, or sterilizing the oil; of prompt treatment for minor injuries, removal of infected men, and recommendations to the men concerning the importance of personal cleanliness, are all helpful. But it is necessary to go a step further and keep the oil continuously free from living infectious agents.

A disinfectant was found, a mixture containing coal-tar compounds, which is an effective germ-destroyer in oil. Careful tests were made; the oil from several machines was analyzed again and again. Examination showed millions of pus-forming bacteria. The mixture was added and the oil analyzed again, after one hour, after five hours, and after ten hours. Not a germ was found.

Careful observation established a working formula of 1 per cent of the mixture to be added to the oil at the time of initial application and 1 per cent to be added at each subsequent renewal. With hobbing machines, however, where the working temperature is some 20 degrees higher and the antiseptic is volatilized faster, it is necessary to add 1 per cent of the mixture between renewals of oil.

An unexpected benefit was also derived from the addition of the purifier to the oil. Hair follicle rash, from which men working in oil have suffered continually, disappeared. Not only, therefore, was the danger which the oil had offered overcome, but the addition of the antiseptic served as a purifier for skin troubles.

The Ball and Roller Bearing Division of the S.A.E. has recommended that the standard for metric roller bearings be cancelled as the inch size meets all requirements. There seems to be no crying need for the metric system in this quarter.

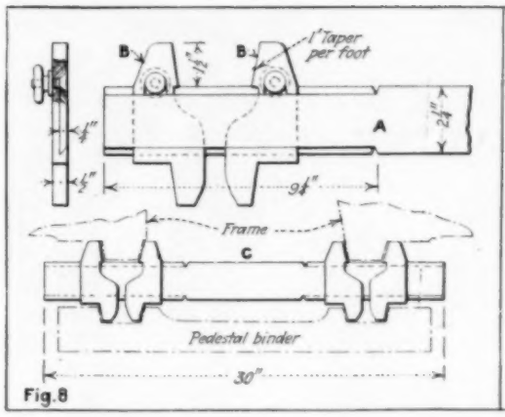


Fig. 8

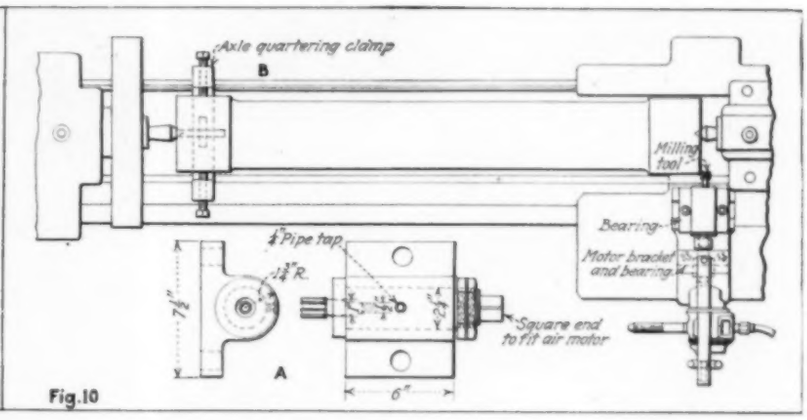


Fig. 10

*Fig. 8—Adjustable pedestal-binder gage. Fig. 10—Air-operated attachment for cutting keyways in driving axles*

# Handling Repairs of the Union Pacific at Cheyenne

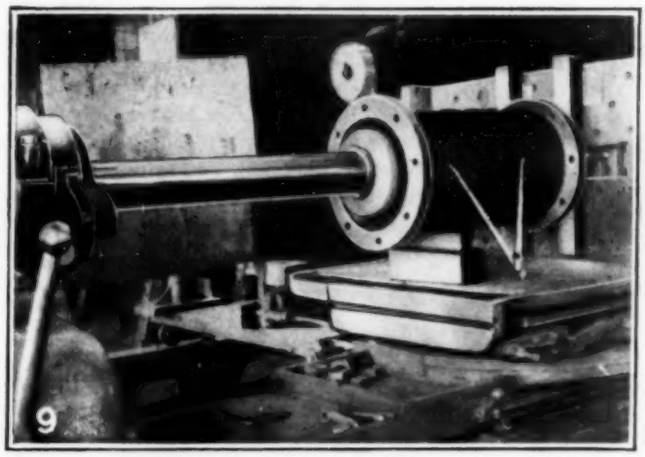
By Frank W. Curtis
*Western Editor, American Machinist*

## Grinder for cylinders and rods—Pedestal-binder gage simplifies fitting binder to frame—Air-operated keyway miller and a valve-bushing puller—Portable tool box

AT THE Union Pacific shops, Cheyenne, Wyo., efficient methods are in use in the reconditioning of motive power. One of the time-saving tools used in erection work is the pedestal-binder gage illustrated in Fig. 8. The gage is an inexpensive tool, yet it saves considerable time in fitting binders to the pedestal jaws. The body *A*, 30 in. in length, is dovetailed at both ends to receive the sliding blocks *B*. The blocks are locked by thumbnuts and countersunk-head screws, as shown in the end view at the left. In use, the gage is placed against the ends of the pedestal jaws, after which the sliding blocks are adjusted to span the tapered parts of the jaws, as shown at *C*, and are clamped in position. The gage blocks are so made that when the upper parts are in contact with the pedestal jaws, the lower parts form templets for scribing the binders for the notches to fit the jaws. From this setting, the binder is marked off, then machined. The setting of the gage is not altered until the binder has been completed.

Air-pump cylinders and various other units are ground in the planetary machine illustrated in Fig. 9.

The second and concluding article.



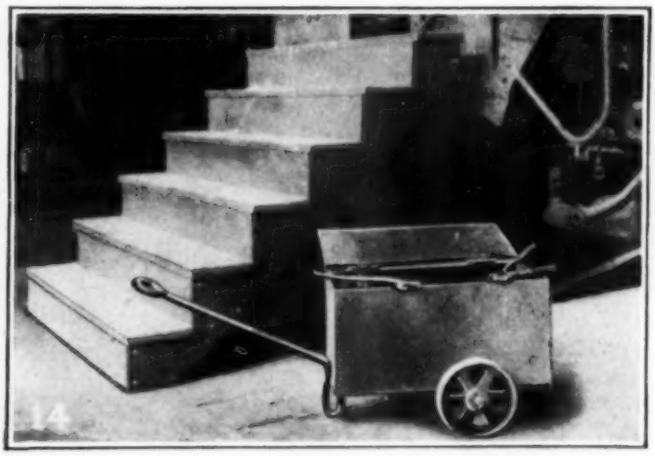
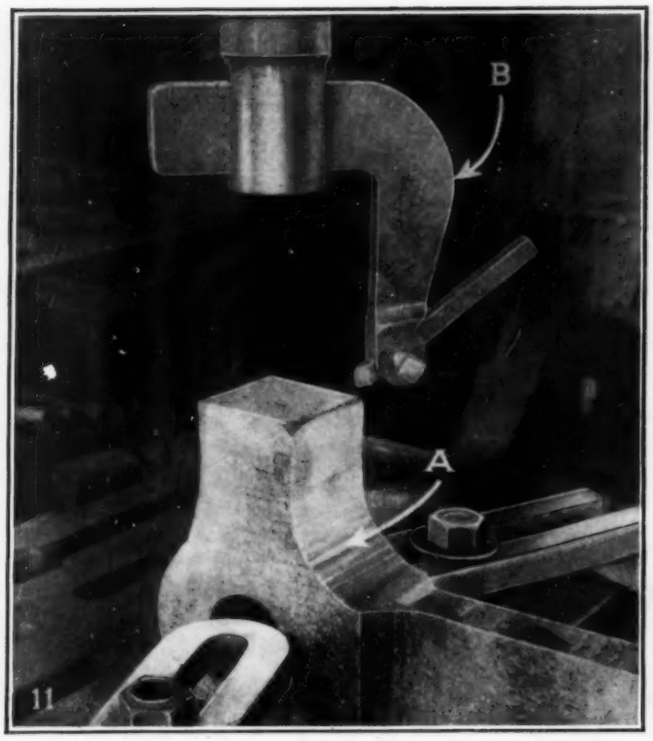




*Fig. 9—Grinding a reverse-gear cylinder. Fig. 14—Portable tool box and steps in the erection shop*



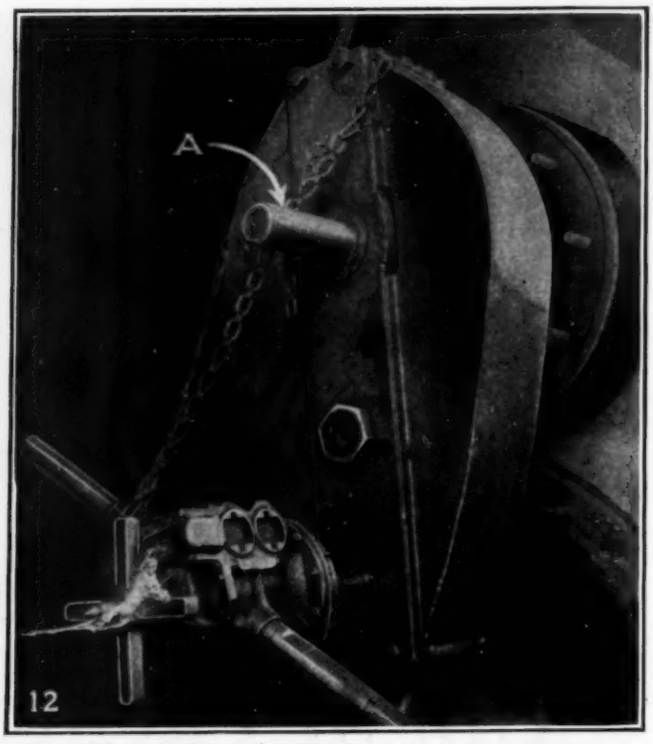




*Fig. 11—Turning the grease-cup section of a motion rod. Fig. 12—Device for removing and putting in valve bushings*

The work shown in place, is the cylinder for a power reversing-gear. It is clamped against a pair of parallels so that the abrasive wheel can pass through the bore without interference. An outboard support is required for the projecting end of the work to insure alignment. The amount of material removed is dependent on the condition of the cylinder, but in any case the amount is just sufficient to clean up the bore. The eyes in siderods are ground on this machine, and on work of this class, $\frac{1}{32}$ in. of metal is allowed for grinding. The cylinders of cross-compound air pumps are ground while assembled, so that they will be aligned properly.

Keyseats in driving axles are machines in a lathe by the air-operated attachment illustrated in Fig. 10. The device is composed of a spindle and a bearing attached to the compound rest, also a bracket that supports an air motor. Movement of the carriage feeds the cutter lengthwise of the axle. Constructional details of the spindle and bearing are shown at *A*. The axle is located and held in place by the quartering clamp *B* attached to the ways of the lathe. When one end has been completed, the axle is turned end for end, and is re-located by a finger plate in the quartering clamp that fits the previously milled keyseat, enabling the keyseats to be cut at 90 deg. from each other.

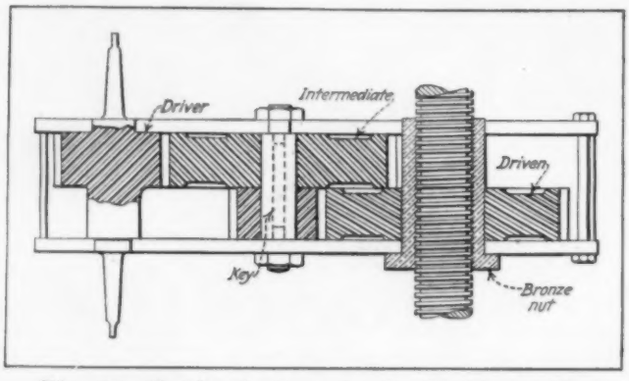



*Fig. 13—Sectional view of valve-bushing puller*

The grease-cup section of motion rods is forged in a rectangular shape and is rough machined in the planing and slotting operations, as shown at *A*, Fig. 11. Since it must be made cylindrical, the work is done in a drill press equipped with the offset toolholder *B* attached to a bar held in the spindle. Approximately five or six cuts are required to round the section. The tool is operated at 40 r.p.m., and at $\frac{1}{32}$-in. feed per revolution. The tool is adjusted by sliding the holder in either direction in the slot in the bar, and is locked in position by a wedge.

Valve bushings are withdrawn and pressed in place by the device shown in Fig. 12. The screw *A*, driven through gearing by an air motor, can be operated in either direction and, likewise, the motor can be connected to either side of the device. In Fig. 13 is shown a sectional view of the unit. The hub of the driven gear is bushed with a bronze nut that engages the screw. The draw plate attached to the outer end of the screw, and bearing against the valve bushing, prevents the screw from turning while the driven gear revolves.

In Fig. 14 is shown a portable tool box such as used by workmen in the erecting shop. It is made of $\frac{1}{8}$-in. sheet steel, welded together. It has two 11-in. wheels so that it can be transported quickly and placed conveniently to the workman. Each box has a lock to safeguard the tools. The steps shown in the rear are used in connection with erection work, each pit being provided with a set.

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Some idea of the growth of electric arc welding can be had from the fact that one plant of the General Electric Co. now uses 1,000 carbon pencils, 13,500 lb. of welding wire, 40,000 kw.-hr. of electricity every day and does 67,500 ft. of welding per month.

# Applying Electrical Equipment to Production Machinery

By Robert Corey Deale
*Electrical Engineer, Niles-Bement-Pond Co.*

## Constant-speed motors generally applied to production milling machines—Advantages of electric over mechanical feed for planer-type milling machines—D.C. and A.C. equipment compared

MILLING machines may be roughly divided into the column-and-knee type, the vertical type, and the planer type, although there are a number of special machines that do not fit exactly into any of these classes.

The column-and-knee type shown in Fig. 112 includes the largest number of milling machines, as they are very largely used in the production of small pieces of various sorts. The electrical equipment used is as a rule very simple, as the motor is usually left running constantly, with a clutch, generally of the friction type, for starting and stopping the spindle and with change gears for obtaining the various spindle speeds. The usual motor is of the constant-speed type, both for d.c. and a.c., with all changes of speed obtained mechanically. This arrangement works out very well as far as the manufacturers of the milling machines are concerned, but it does not seem to take full advantage of the possibilities of d.c. electrical equipment. It would seems that a d.c. driving motor with a three-to-one speed range and either one or two gear changes would be much preferable to the present arrangement. In that way, there would be a minimum of gears between the motor and spindle, fewer parts to maintain, a steadier drive, and control of the spindle by a start-and-stop push button. There would be a large number of spindle speeds, easily obtainable by turning the knob of a field rheostat.

For a.c. drive either a multi-speed or constant-speed squirrel-cage motor may be used. If the multi-speed motor is adapted, the machine may be identical for both d.c. and a.c., as the usual multi-speed motor gives four speeds over a range of three to one. Should a constant-speed a.c. motor be used, additional gear changes are necessary to give the required number of spindle speeds.

For constant-speed a.c. motor drive standard squirrel-cage motors with manual starters of the resistor or compensator type may be used. There is no great advantage in automatic control for a machine having a friction clutch to start and stop the spindle.

For constant-speed d.c. motor drive, shunt-wound motors with inclosed faceplate starters are satisfactory. The motor should have solid covers on the top half, unless it is set into the pedestal of the machine as in the machine shown in Fig. 113. When inclosed by the pedestal, louvres or screen openings must be provided to allow circulation of air for cooling purposes. The

The fourteenth article. The fifteenth will appear in an early issue.

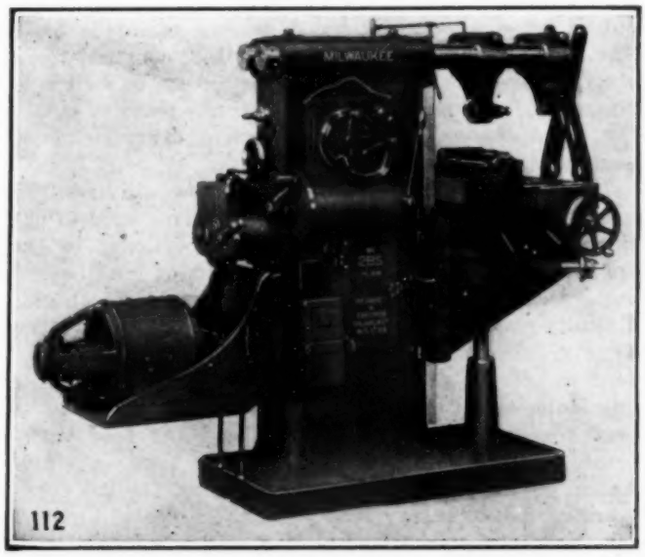



*Fig. 112—Column-and-knee type milling machine*

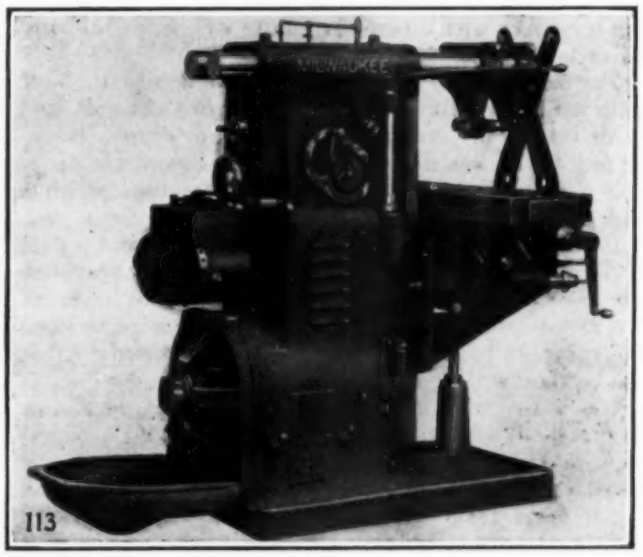
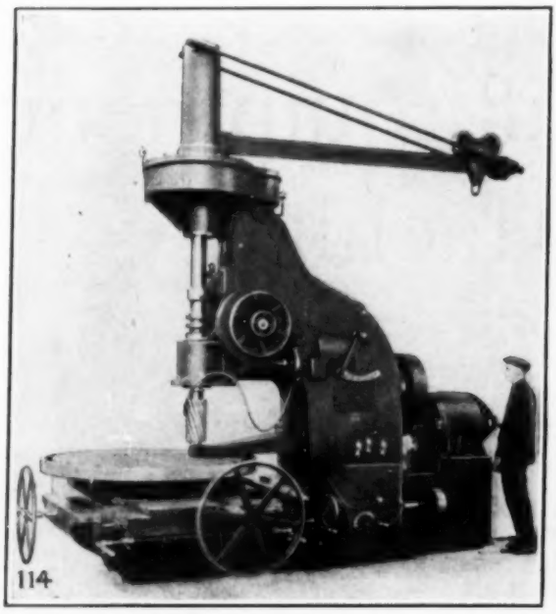



*Fig. 113—Milling machine with built-in motor drive*



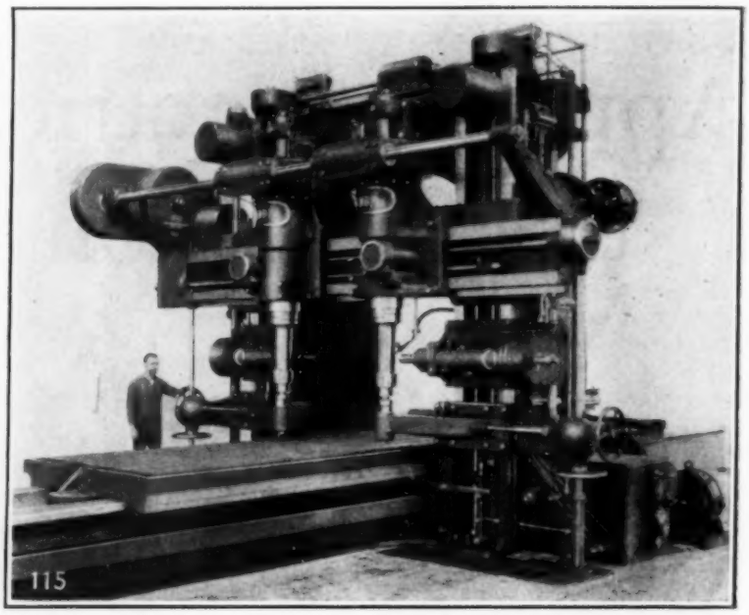




*Fig. 114—Vertical milling machine of large size. Fig. 115—Large planer-type milling machine with complete electrical equipment*

openings should be so located as to allow as free a passage as possible.

For adjustable-speed d.c. motor drive, shunt-wound motors of three- or four-to-one speed range should be used, together with an automatic, non-reversing controller, having dynamic braking, with one or two start-and-stop push buttons, and an inclosed field rheostat. The motor should be protected against chips, either by mounting it inside the pedestal, or by providing solid covers on the top half.

Small vertical-spindle milling machines use the same types of electrical equipment as the column-and-knee machines. The larger machines, such as the one shown in Fig. 114, however, require more elaborate equipment. The spindle is driven by one motor, while the table may be fed by one or more separate motors, or may be geared to the driving motor. The motor driving the spindle should be capable of starting with the cutter buried in the work, and should be provided with means for reversing the direction of rotation. A non-reversing controller with a reversing knife switch, will usually be satisfactory.

For drive by d.c. motors, the machine is usually built with not more than two mechanical speed changes, and is driven by a shunt-wound motor providing a three- or four-to-one speed ratio. Drip-proof covers are desirable although not absolutely necessary for this machine.

A dynamic braking automatic controller, with push button for starting and stopping the motor, and a field rheostat for speed adjustment, should be provided. This controller should provide some means of reversal, but a non-reversing controller, if used with an inclosed reversing knife switch for emergency reversal to free the cutters, will be satisfactory.

Where the machine is to be driven by an a.c. motor, two methods are available. In the more usual arrangement, a constant-speed motor is used with three or four speed changes by means of a mechanical change gear box. Some form of motor having a relatively high starting torque, such as a slip-ring or double squirrel-cage induction motor should be provided to insure that the machine may be started after having been stopped with the cutters in the work. Should it be desired to use a squirrel-cage motor, a friction clutch should be provided so that the motor may first be brought to speed without load and then connected to the machine.

If a friction clutch is provided, any form of starter may be used, as the clutch, not the starter, is used to control the spindle. A resistor- or compensator-type, manually-operated starter is cheap and satisfactory for this service.

When a high starting torque motor is used without a friction clutch, a controller should be used which may easily be reached by the machine operator when he is standing in the natural operating position. An automatic reversing controller with a start, stop and reverse push button near the spindle is very desirable.

Multi-speed squirrel-cage motors are desirable for service of this sort, as they may be used with the machine as built for an adjustable-speed d.c. motor, and thus eliminate the additional gear box which is required when a constant-speed driving motor is used. The control is the same as for the constant-speed squirrel-cage motor except that some form of switch is necessary for changing the motor connections to obtain the speed changes. A special type of drum switch is usually supplied for this purpose.

In most machines the various feeds are obtained mechanically from the driving motor. This method has the disadvantage that feeds are proportional to the spindle speeds where adjustable-speed or multi-speed motors are used. There are two ways in which this difficulty may be overcome. The machine may be driven by a single constant-speed motor with all speed and feed variations obtained by shifting gears, or separate adjustable-speed d.c. or multi-speed a.c. motors may be used for obtaining independent speed and feed variations. Where separate feed drive is used, a single motor, engaged by clutches, may be used for the cross, longitudinal, or rotary feed motion, or separate motors may be used for each feed motion, with the rate of feed determined by the motor speed. Two or more of the

motors may operate at the same time when it is desired to obtain other than simple feeds, while a pendent switch system may be worked out to allow momentary push-button control for traversing the carriage or for milling irregular shapes. An electrical system of this sort is somewhat complicated, but it places the control of the work directly under the hand of the operator to a higher degree than is possible with any other system. An experimental machine has been built along these lines and has proved very successful.

Reversing automatic controllers should be used, whether direct or alternating current is used. Dynamic braking makes the machine easier to control, and should be used whenever direct current is available. For electric feed machines, direct current is very desirable for the feed motors, if it is at all available, even if an a.c. driving motor be used.

For machines having mechanical feeds, a traverse motor is usually provided for traversing the work approximately into position. A high-resistance-rotor, squirrel-cage motor with a reversing drum switch is used, or a series or high-compound, totally-inclosed d.c. motor with a small reversing drum controller having a single step of starting resistance should be used. Automatic reversing controllers may be used because of their convenience, but they are more expensive than the small drums, and are usually more likely to give trouble because of their light construction.

### Independent Driving Speeds

Planer-type milling machines must have means provided for driving both the table and spindles, preferably at speeds which are independent of each other. This requirement may be met by the use either of a constant-speed driving motor with separate trains of gears for obtaining the various spindle speeds and feeds, or by the use of separate motors. Both types of machines are on the market.

The large planer-type milling machine shown in Fig. 115 is a particularly large machine in which individual motors are used for the various operations. The motor on the floor at the front of the machine is used to feed or traverse the table or any head, or to raise or lower the cross rail. The smaller motor near the top of the front housing is for driving the spindle of the side head on the front housing, while a similar motor on the rear housing drives the spindle of the back side head. The two main spindles on the cross rail are driven by a motor (not shown) located on the foundation at the rear of the machine. By the use of the several motors in this way, the mechanical parts of the machine are much simplified as cross shafts and driving gears may be largely eliminated, and the machine is made easier to handle. Adjustable-speed d.c. motors are used in all cases, so that variation of speed or feed is accomplished by adjusting the proper rheostat. Automatic reversing controllers were used for all motors, so that any operation may be controlled by the proper push button.

The all-geared machine, with a single constant-speed motor presents the manufacturing advantage of having the machine identical for both a.c. and d.c. drive, but it is at the expense of an increased complexity of the mechanical parts of the machine where direct current is available. The failure to take full advantage of the possibilities of electric drive causes the machine to be more difficult to operate than would otherwise be the case, as gears must be shifted to change speeds and feeds while with a d.c. driven machine the same result would be obtained by turning the knob of a field rheostat. With separate electric control of the feed, there are other important advantages. The most important of these is the electrical interlocking of the driving and feed motors so that, in case of a slight overload of the driving motor the rate of feed is automatically reduced, to be automatically returned to its normal speed as soon as the condition causing the overload has been removed.

If either feed or driving motor be overloaded, the entire equipment will shut down. The feed cannot be started until after the spindles have come to full speed, while, if the machine is shut down for any cause, the feed is stopped promptly by dynamic braking while the spindles coast to a stop, thus preventing any possibility of jamming a cutter in the work. With a geared machine, however, if the feed mechanism be overloaded, the only relief is the breaking of a gear, while the cutter is always stopped with its teeth embedded in the work, and never has a chance to clear itself, as does the machine with the electric feed. There is usually some direct current available, even in an a.c. shop, and so this type of control may be used, using an a.c. driving motor and a d.c. feed motor as in the slab miller shown in Fig. 116. The driving motor for such a machine should either be of a type having high starting torque, or should drive the machine through a friction clutch, which is used for starting and stopping the spindles. For a machine with a single constant-speed motor, a drip-proof, shunt wound d.c. motor, or squirrel-cage or slip-ring a.c. motor should be used.

A reversing knife switch may be used to allow the rotation of the spindles in the opposite direction when necessary, together with a simple form of starter, usually of the manual type, although an automatic controller is preferable if the increase in cost is not prohibitive. While a friction clutch for starting and stopping the machine is usual, it would seem better practice to provide a push button in some convenient location for operating an automatic controller, and start and stop the motor to control the spindle. When alternating current motors are used without a friction clutch, some form of motor having high starting torque, such as the slip ring or double-rotor induction motor is desirable, to permit starting the motor while the tool is embedded in the work. Some form of simple automatic starter may be used. For slip-ring motors,

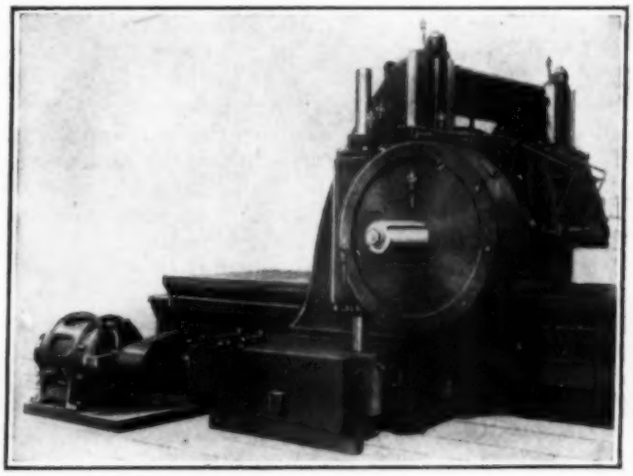


*Fig. 116—Slab miller, showing spindle-driving motor*

the standard non-reversing controller for driving wheel lathes is very satisfactory as it comprises a simple non-reversing controller and a knife reverse switch built into a single cabinet. For double squirrel cage motors, an across-the-line type of controller may be used unless there is a provision in the contract with the power company limiting the current inrush. In such a case, a resistor type of starter should be used, set at rather a high tap to avoid too great a reduction of the starting torque.

With the double motor drive where direct current is available, both driving and feed motors are three- or four-to-one adjustable-speed, shunt-wound motors, with a special type of automatic controller for interlocking both feed and drive operations. For normal operation, the pressing of a start button brings first the driving motor up to speed, and then the feed motor. There are individual field rheostats so that the speeds may be independently adjusted. If the driving motor be slightly overloaded, the feed motor drops back to its lowest or full-field speed until the overload is relieved. Serious overload of either motor shuts down both. The feed motor may be independently operated by a separate push button, so that it may be used to rapid traverse either the table or any of the heads. Dynamic braking should be provided for the feed motor but not for the driving motor to insure that the feed be stopped before the spindles stop revolving.

Where the shop is mainly driven by alternating current, with some direct current available, a slip-ring induction motor may be used to drive the machine, with an adjustable-speed d.c. feed motor. The control in this case would be the same in general as that for the all d.c. equipment, except for the changes necessary to adapt it for the a.c. driving motor. A high-torque, double-rotor squirrel-cage motor might be used in place of the slip-ring induction motor.

A third motor might be used for elevating the cross rail. For direct current, this motor would be series or compound wound, preferably fully inclosed, with a simple reversing drum controller having a single step of armature resistance. For alternating current a half-high-torque, squirrel-cage motor with a simple drum reverse switch is satisfactory.

# The Wrong Way to Sell Machine Tools

By F. P. Terry
*Belfast, Ireland*

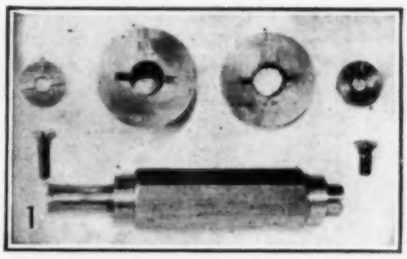
IT IS often proclaimed that machinery is the basis of the world's progress, and that machine tools are the foundation of all machinery. It may also be said that, in the machine-tool advertising field, such a high standard is maintained, truthfulness counting above all, that buyers have, in most cases, lost all suspicion in this direction. If the reputation is to be maintained, advertising must be continually backed by equal truthfulness on the part of the machine-tool salesman; otherwise much of its true value is likely to be lost. Consequently the selling or marketing of machine tools calls for more consideration than that given to mere merchandise that can be handled by any Jack-of-all-trades, who will sell anything for a fee, and, when asked to explain something, quickly gets out of the difficulty by declaring that he knows nothing, or attempting to bluff the would be purchaser.

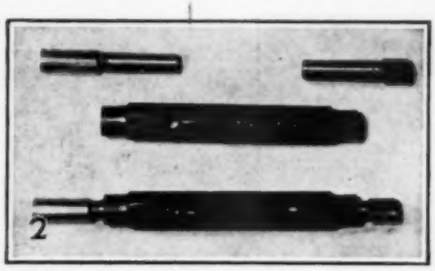
A few days ago the writer was consulted by a brother engineer regarding the purchase of a machine tool. Although a clever and level-headed man in his own line, he knew very little of the fine points of machine tools and badly needed advice of the right sort. Having explained what he wanted to do, he produced three quotations, one of which covered a well-known and much-advertised machine tool. Knowing this machine and the reputation of its maker, I at once saw that it was ideal for the work to be done and, losing no time in coming to a decision, recommended its purchase with confidence.

Much to my surprise, serious objections, not to be overcome by my persuasion, came from the intended purchaser, and either of the other two quotations, one of which was much higher, due to accessories not essential in this case, was preferred. On inquiring for the cause of this attitude, the trouble was soon located. A day or two after receiving the quotations my friend received a visit from, to use his own words, "the biggest liar on earth" who explained that he represented the importers of this tool. This Jack-of-all-trades one day is offering the "best oil in the world"; he doesn't know why it is the best, he says so and that should be enough for any machinist. The next day he is back again offering the "fattest candles," or something of the sort; and to give such a man an order, to again quote my friend, is "to inflict upon oneself an incurable disease more irritating than the itch" and, since he had one such experience, nothing I could say or do would induce my associate to risk a second attack.

Quite recently a similar salesman, who handles transmission appliances without having the slightest knowledge of their uses, called upon the writer. He had sold a lathe to someone and wished me to recommend a reliable maker. On being asked what sort of a lathe had been ordered, he replied, "My order is one lathe." Attempting to explain that there were many and varied contraptions known as lathes caused him to become hostile and further explanations were postponed.

To send such men to transact business with the average machine tool buyer is only to bring contempt upon the machine tools and their makers. If it is not possible to follow up inquiries with a salesman whose whole interest is confined to the firm and who knows enough about them and their specialties to speak the truth, it is advisable to depend solely upon advertising and letters. The old-type foreman, who was annoyed at receiving "printed letters" because he could read ordinary writing quite easily, disappeared long ago and his successors much prefer and are pleased to receive letters of any kind in preference to dodging an "incurable disease." One of the largest buyers of machine tools, known to the writer, would not waste a moment of his time with this type of salesman and any attempt of the same to approach him is liable to put the firm represented outside the ring, and probably off his inquiry list for all time. If information is required concerning new machine tools, it is almost sure to be of the kind that cannot be delivered by one having no knowledge of the goods, and a buyer is not in the market for the purpose of being fooled.



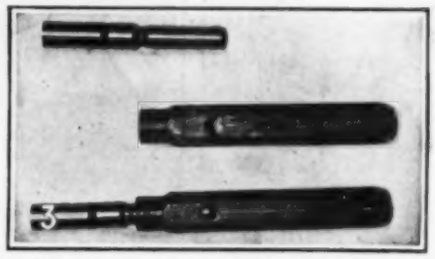




*Fig. 1—Plug gages with reversible-type ends. Fig. 2—Taper-locking type of double-end plug gage. Fig. 3—Progressive type*

# The Relation of Finish to Life of Plug Gages

By L. M. McPHARLIN
*Supervisor of Gages and Inspection Methods*
*The Studebaker Corporation of America*

**Tests show that gages with mechanically-lapped surfaces have much longer wear lives than hand-lapped gages, which excel ground gages—Microphotographs indicate the progressive stages of wear**

IT IS a common error in analyzing gage cost to consider primarily only large and expensive types of gages, such as gaging fixtures, and special-purpose gages, the initial cost of which is high, instead of giving attention to the small, comparatively inexpensive, but perishable gages. For example, due to the greater and more conspicuous expenditure required at the time of purchase, a $500 gaging fixture that has no appreciable maintenance cost, is quite likely to receive much more consideration in analyzing gage cost than a $15 perishable gage with a $600 monthly maintenance cost. In analyzing this cost further it will be found that in the majority of shops the most expensive of the perishable gages is the cylindrical plug gage, the expense of which is governed by: (1) Initial cost, which is affected by design; (2) maintenance cost, which is affected by design and wear life. To realize the greatest economy obtainable in both the initial cost and the maintenance cost the designer should take into consideration as important points: (1) One standard design of gage; (2) interchangeability of "Go" and "Not Go" ends and handles; (3) reversible type of ends, where size permits; (4) handles of proper length; (5) double-end type preferred. In order to buy at satisfactory prices it is necessary to allow the purchasing department several sources of supply, and if the design is not standardized it becomes necessary to carry replacements on several different designs, thereby increasing the maintenance cost. It is obvious that several sources of supply are most desirable as this practice has a tendency to stimulate competition among gage manufacturers, thereby controlling prices and lessening the possibilities of inferior quality.

The life of a Not Go end is five to ten times as great as a Go end and with ordinary use a handle will last indefinitely, therefore it is necessary to have ends and handles interchangeable to eliminate scrapping the Not Go end and handle when only the Go end is worn out. In large sizes and ordinary lengths the reversible-type ends, Fig. 1, are most desirable as they can be reversed when one end is worn, thereby giving double life. To obtain maximum inspection in quality and quantity it is essential to have gage handles of sufficient length to fit the operator's hand. To properly gage on ordinary work the handle of the gage should be gripped in the operator's hand and *not* by the finger tips. Until this point was called to their attention most suppliers were furnishing gages up to ½ in. diameter with handles 1½ to 2 in. in length. The proper length should be at least 3 in., as shorter than this causes the Not Go end to gouge into the palm of the operator's hand

*Fig. 4—Classification of finish*

Paper read at a meeting of the Gage Steel Committee held at the Bureau of Standards, Washington, D. C. on Feb. 25, 1927. Its publication has been indorsed by the Gage Steel Committee.

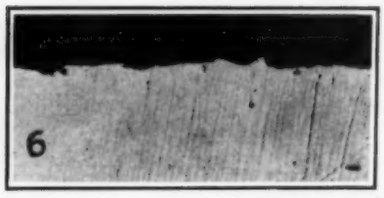



*Fig. 5—Appearance of ground hole, magnified 70 times*
*Fig. 6—Cross-section of surface shown in Fig. 5, total magnification 280 times*

when plugging with the Go end. The double-end type of gage, Fig. 2, is preferred to the single-end type, Fig. 3, due to its greater economy in maintenance cost and in time of operation. The single-end type is inferior for the following reasons:

(1) When the Go end is worn out, the Not Go step must be scrapped

(2) It cannot be furnished in a mechanically-lapped finish

(3) Tests show that it is slower to operate

(4) It passes inferior work, as the detection of bell-mouthed holes is improbable.

Nor is the solid type of plug gage to be recommended due to the expense caused by the necessity of scrapping the complete gage when only the Go end is worn undersize. Also these gages can only be furnished in ground and hand-lapped finishes, neither of which is economical.

When a satisfactory design of gage is standardized a further analysis of gage cost will disclose the final and important item affecting the maintenance cost, namely, wear life. An examination of the maintenance cost will indicate that the depreciation is greatest on close limit plugs of the 0.0005- to 0.0010-in. tolerance class, and especially in sizes up to 1 in. in diameter. A plug gage that has a 0.020-in. tolerance generally is replaced yearly and the life is governed mostly by mutilations and rust, while on the other hand a plug gage with a 0.0005-in. tolerance is replaced daily, or sometimes several times daily, and the life is governed by wear only.

The value of surface finish on the wear life of plug gages has been a much debated question. Until recently, gage manufacturers themselves neglected or failed to realize this factor and it was only after persistent demands were made that they began to take steps to secure a surface finish superior to the regular hand-lapped finish. Some manufacturers, on the strength of this demand, have installed mechanical lapping devices in order to meet these finish requirements.

Gage makers formerly based claims for their product on the selection of steel, its heat-treatment, and the precision of their work. The finish was either ground or hand-lapped and was entirely an element of personal and visual judgment, so that the finish varied within wide limits with different makers, and even with different gages from the same maker. In competitive tests one supplier's gage may show better wearing qualities in one shop than in another. The results of our tests show that this discrepancy is due to the variation of finish on the gages, and the varying conditions during the test, rather than such factors as steel, hardness, and size, which are generally satisfactory.

It is not the purpose of this article to go into detail on the methods of securing the finishes, as this was left to the gage maker, except to say that the mechanically-lapped surfaces, with one exception, were produced by the Hoke method. Nor will it be necessary to discuss steels as we believe that each maker has carefully selected the best types of steel, treatment and hardness. However, it should be noted that the steels and treatments used should give the following results:

(1) The steel should have a dense structure and should be an alloy steel, as high-carbon steel is too brittle and case-hardened low-carbon steel will not stay round.

(2) The hardness should be from 75 to 85 scleroscope. Hardness above 85 is not necessary if the proper steel is used, and it has been found that a gage hardened to 75 in many cases has a greater wear life than those hardened 85 to 90. In fact, some of the gages that gave an exceptional wear life could be touched with a file.

(3) The finish is most important and should be as smooth and uniform as it is possible to produce. We have found in our tests that the quality of finish governs to a greater extent than any other factor the wear life of plug gages; and when factors such as the steel, its treatment and hardness are equal, finish is the deciding factor in the wear life.

The experiments described were in progress for two and a half years and were necessarily slow in terminating as the gages were used on production inspection and were carefully watched to avoid errors of any nature. Seventy-seven gages were tested and, as several of the high-finished gages plugged as many as thirty thousand holes, the continual checking of results consumed considerable time. However, we wish to present the results obtained, which though small in quantity are nevertheless quite conclusive, in the hope that others may take up the work and contribute further data in this promising field of investigation.

Many methods of testing have been devised for determining the wearing qualities of one metal against another, but none can test the wear of a plug gage as accurately as the actual conditions met with in service. Such being the case it may be said that the only true determination of the life of a gage must be made in the shop under standardized conditions throughout the test. Therefore, in order that the results of these tests be mutually beneficial it is necessary that the gage users co-operate with the gage suppliers to the extent

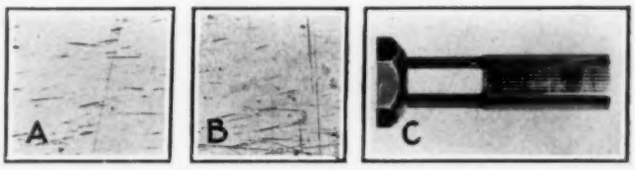



*Fig. 7—Defective gage*
*A*—Original surface (60x). *B*—Surface after 50 holes had been plugged (60x). *C*—Appearance of gage showing flats

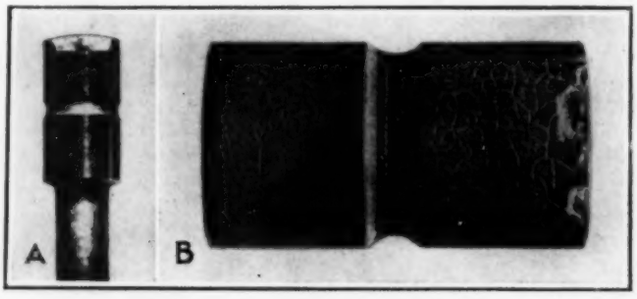



*Fig. 8—Defective gage with grinding checks*
*A*—Normal appearance. *B*—Checks exposed by pickling in acid (2.5 times)

of running tests and furnishing the suppliers the results.

The object of the tests was to prove to a recommended supplier that an ordinary good, ground finish was not suitable and would not give a satisfactory wear life on close tolerance work. A lot of gages was run in the shop and an accurate check kept of the wear life. It developed that the life of these gages was very short as they plugged less than two thousand holes. The demand was then made for better finish. As a result the next lot of gages was hand lapped and showed considerably longer life in service. From that time on, every gage entering the plant was examined under a microscope for average fineness of finish and classified into one of the three divisions shown in Fig. 4. A poor finish has a surface composed of a series of ridges and hollows offering quick-wearing high spots and grit- or dirt-catching hollows. A fair finish has a surface comparatively smooth, but containing some high sections and scratches from the lapping, while a good finish has a surface much smoother, with less scratches and high sections. These gages were all hand lapped. Each was characterized by much non-uniformity of finish, and few, if any, were satisfactory throughout the entire surface, particularly on the end of the plug, at which place wear starts and progresses the fastest. The gages classed as "Good" were so rarely found that we could not secure any for our tests. The gages classed as "Fair" and "Poor" represent the average of hand-lapped products. With the fact apparently established with our suppliers that a better finished plug would give longer life, the demand was made for even better finish. This resulted in the development of the mechanically-lapped plug which eliminated all of the undesirable features of the hand-lapped gages, such as the presence of ridges and non-uniform size and finish. Tests were then started to compare these with hand-lapped plugs to see just what effect varying degrees of mechanical-lapped finish would have on the life of gages in service. In running the tests a regular routine was followed. Of each class of finish from every supplier a gage with the average finish was selected and it was on these gages that micrographs were made at various intervals. All gages were carefully measured for size at three points and measurements were also taken at the same places at intervals of microphotographing. Measurements throughout the test were made by the same operator on the same measuring instrument reading direct to 0.0001 in. and estimating to 0.000025 in. In every instance the gages and checking blocks were allowed to remain together from 6 to 12 hours to allow temperature adjustments, and both were insulated while checking.

In running the different gages in the shop the same inspectors used the gages on all the tests. The pieces to be plugged were all uniformly washed in a cleaning compound, dried, swabbed, counted and then plugged. The gages were alternated so that one gage would not have a steady run of plugging high- or low-limit holes. By carefully watching these points we believe that the testing conditions were made as uniform as it was possible to have them. This resulted in close checks on each set of gages, no one gage being given an unfair test. In order to compare the life of gages having a slight variation in original sizes, the results have been based on the number of holes plugged to wear the gage 0.0001 in., the position of measurement being the middle of the gage cylinder. The plugs were made in three different sizes: 0.374 in. for gaging cam rollers having a carbonized and ground hole; 0.373 in. for gaging the small reamed holes in rocker arms made of 0.30- to 0.40-carbon steel, annealed; and 0.4995 in. for gaging the large broached hole in rocker arms. The Go end of each had a tolerance of +0.0001 in. and the Not Go end, −0.0001 in. The true action of plug gage wear is a lapping of its surface, and every plugged hole presents some different combination of dirt, grit, fine slivers of steel and high sections. Imagine, if you will, a highly-magnified view of a hand-lapped or ground gage passing through a hole. There are two surfaces, the one on the gage, which is composed of fine threads running in both directions similar to a double knurl, and the other on the plugged piece, Figs. 5 and 6, a rough, threaded surface showing many high sections. During the course of travel of the plug through the hole, particles of dirt, grit, slivers and high sections will first tear down all high sections of the gage surface corresponding to the threads or double knurl. However, in doing this enough abrasive matter is accumulated to cause further scratches and develop more ridges and hollows. This tearing down of old high sections and building new ones continues until the gage is undersize and is discarded. On the other hand, a mechanically-lapped surface with a high finish cannot have high sections similar to threads and therefore will not

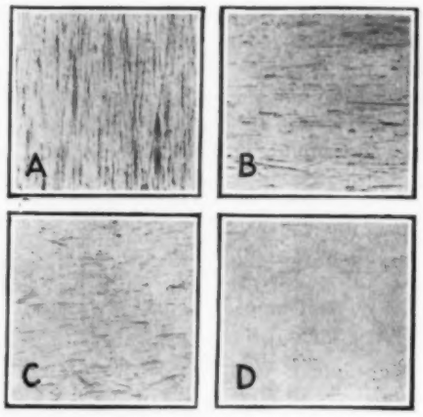



*Fig. 9—Four classes of finish on gages supplied by A*

*A* — Hand-lapped. *B* — Ordinary mechanically-lapped. *C*—Good mechanically-lapped. *D*—Excellent mechanically-lapped

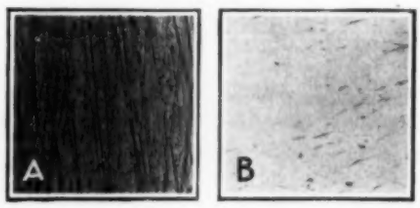



*Fig. 10—Classes of finish on gages supplied by B*

*A*—Hand-lapped. *B*—Good mechanically-lapped

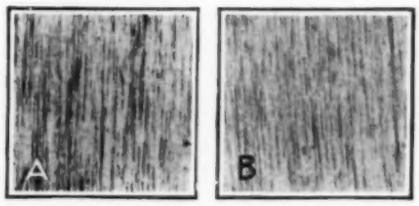



*Fig. 11—Classes of finish on gages supplied by C*

*A*—Hand-lapped. *B*—Poor mechanically-lapped

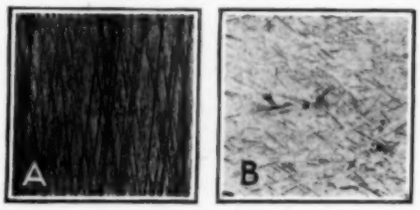



*Fig. 12—Classes of finish on gages supplied by D*

*A*—Hand-lapped. *B*—Fair mechanically-lapped

scrape through a hole and accumulate abrasive matter until the end or weak point of the gage is worn. When this point is reached wear will progress to the back end of the gage, but very slowly.

In securing gages for these experiments no mention of the proposed tests was made to the suppliers and the orders were placed through the regular channels. This method insured test specimens representative of average commercial quality of each company's product and also gave a comparison on the basis of prevailing prices, which varied greatly among the suppliers. For obvious reasons, the manufacturers will be referred to as A, B, C and D, respectively.

As soon as the test was started in the shop, it was found that an accurate and uniform test could not be obtained due to the dissatisfaction caused by the variety of gage designs furnished, such as short solid types and locking types that would not hold the gage members tight on the handle. In order to obtain a uniform test, it was decided that only gages of our design, Fig. 2, would be used in the test, whereupon orders were placed with the suppliers to secure three gages each for the three different jobs and of each class of finish.

## Examination of Test Gages

The first gages received were from Supplier B and after running one of them 50 holes we discovered that the surface was a series of flat spots, which no doubt was not revealed in the microscopic nor by visual inspection due to brightness of the finish and was only detected after plugging 50 holes when the reflection of the high sections on the surface had been destroyed due to action of the wear. This is plainly shown in Fig. 7 at *B*, as the wear scratches show only on the upper and lower portion, or high sections, while the center, or low section, is free from scratches. Several more gages were tested in the same manner and all proved to have the same defect, which was called to the supplier's attention, whereupon we were advised to return the entire lot of mechanically-lapped gages for replacement.

The next gages received were from Supplier D and the microscopic examination revealed a decided improvement in quality of finish, but the surface showed spots similar to pits. Examining these further by pickling in acid, we found these pits to be grinding checks, which caused the ends of the gages to chip off and then pick up grit, thus causing excessive wear. Fig. 8, *A*, shows the condition of one of these gages after running on test in the shop, while *B* shows the checks exposed by pickling in acid (magnified 2.5 times).

As these gages did not appear to us to be a fair representation of the average quality of this company's product, we informed this supplier of the condition, anticipating an exchange for gages of better quality. However, the supplier did not re-act favorably to our suggestion and we were forced to run the ones we had.

Gages received from Supplier C had an inferior quality of mechanically-lapped surface, to which attention was called, but this company was satisfied that its gages would give as good a wear life as any gage on the market. Gages received from Supplies A had a satisfactory finish.

When the replaced gages from supplier B were received, the surfaces of all gages were re-examined and classified as shown in Figs. 9, 10, 11 and 12. It is of interest in comparing the accompanying photographs to note that the abrasive marks on the hand-lapped gages run circumferentially and on the mechanically-lapped gages run either circumferentially or longitudinally according to the method used in lapping. The number of these marks vary inversely with the quality of the finish. Both finishes supplied by C resemble ground or wheel-polished plugs as the scratches and ridges run uniformly around the gage much like fine threads.

The microphotographs shown in Fig. 13 were all taken of the same hand-lapped gage in as nearly the same spot on the surface as it was possible to obtain. The progress of wear on the surface, on both the end and middle of the gage, is quite evident. It will be noted that the fine threads shown on the surface in the original view, through the progress of wear, are removed from the surface on the end of the gage after plugging 250 holes and from the center of the gage after plugging 1,000 holes. The making of new scratches and tearing down of the old scratches continues until the gage is worn undersize. This particular gage plugged 8,000 holes and wore 0.00023 in. or 3,478 holes per 0.0001 in. of wear.

The microphotographs shown in Fig. 14 were all taken on the same mechanically-lapped gage in the same manner as before. The progress of wear on the surface, on both the end and middle of the gage can also be seen. It will be noted that this surface, not having fine threads and high sections, did not pick up the abrasive matter as was common in the case of the hand-lapped surface. In fact, the original surface still shows on the end of the gage after plugging 250 holes and in the center of the gage after plugging 1,000 holes. The surface finish on this gage still shows in the center of the gage after plugging 3,000 holes. This particular gage plugged 25,389 holes and wore 0.00025 in. or 10,155 holes per 0.0001 in. of wear.

The accompanying table also shows a comparison of wear typical of hand- and mechanically-lapped gages.

Comparison of Accumulated Wear of Hand- and Mechanically-Lapped Plug Gages

| No. of Holes Gaged | Hand-Lapped Gage | | | Mechanically-Lapped Gage | | |
|---|---|---|---|---|---|---|
| | End | Center | Back | End | Center | Back |
| 150 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 500 | 0.00005 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1,000 | 0.0001 | 0.00007 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2,000 | 0.00018 | 0.00013 | 0.00003 | 0.00003 | 0.0 | 0.0 |
| 3,000 | 0.00023 | 0.00017 | 0.00003 | 0.00005 | 0.0 | 0.0 |
| 4,000 | 0.0004 | 0.0002 | 0.00003 | 0.0001 | 0.00002 | 0.0 |
| 6,000 | 0.00065 | 0.00028 | 0.00012 Stopped | 0.0002 | 0.00002 | 0.0 |
| 10,500 | ..... | ..... | ..... | 0.0003 | 0.00002 | 0.0 |
| 14,500 | ..... | ..... | ..... | 0.0003 | 0.00007 | 0.0 |
| 20,200 | ..... | ..... | ..... | 0.00045 | 0.00017 | 0.00015 Stopped |

Wear measured in inches.

These two gages differ only in surface finish. They were both of the same size, made of the same kind of steel, hardened to 87 scleroscope, and were tested on the same lot of material. The mechanically-lapped surface showed 454 per cent more life than the hand-lapped surface.

The microphotographs in Fig. 15 show a representative view of the surfaces of mechanically-lapped gages from each supplier and also the progressive wear on each up to 1,000 holes. The wear life per 0.0001 in. is shown on the margin. These data also show that the quality of surface finish governs the wear life to a greater extent than any other factor.

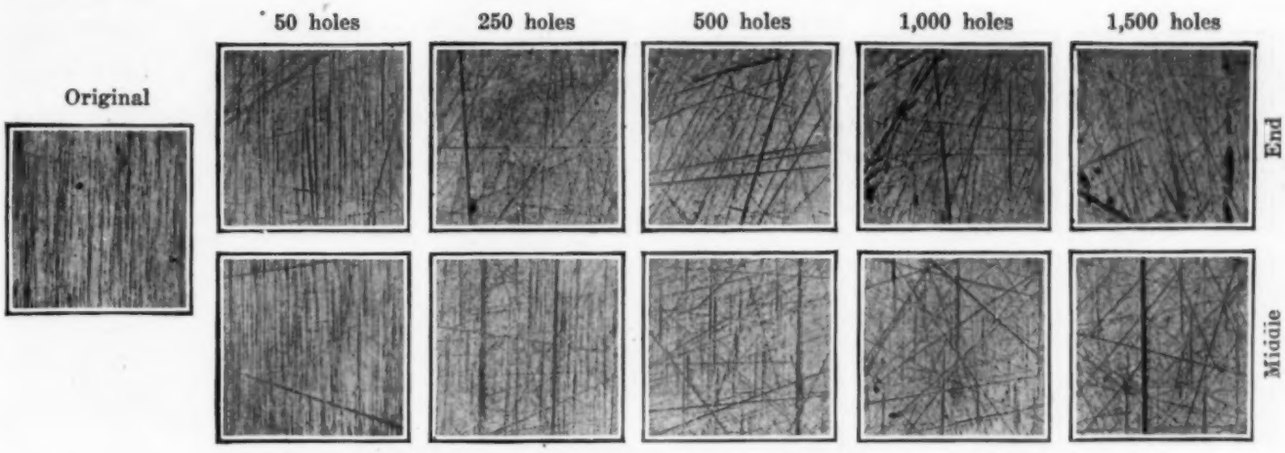



*Fig. 13—Progressive abrasive wear at end and middle of a hand-lapped plug gage*

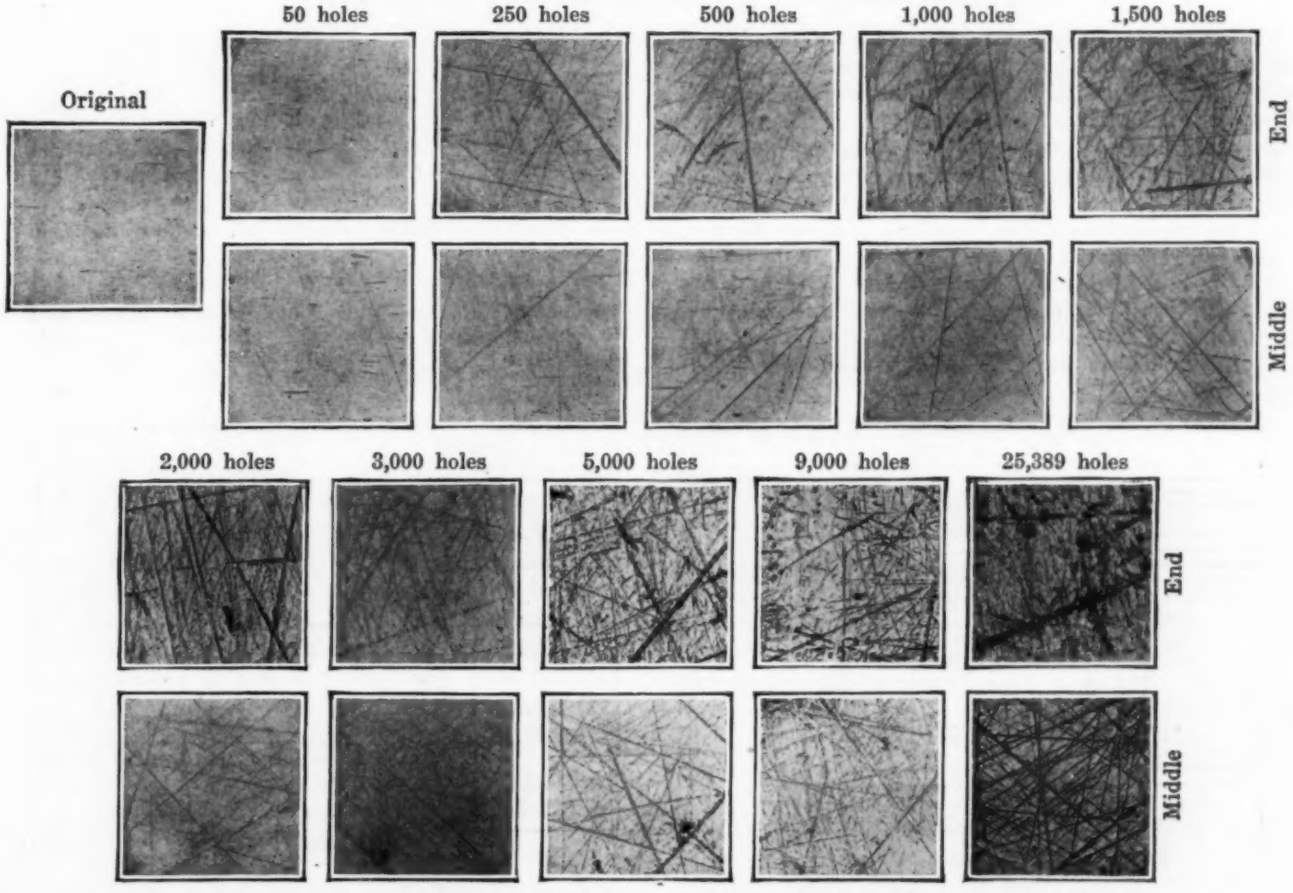



*Fig. 14—Progressive abrasive wear at end and middle of a mechanically-lapped plug gage*

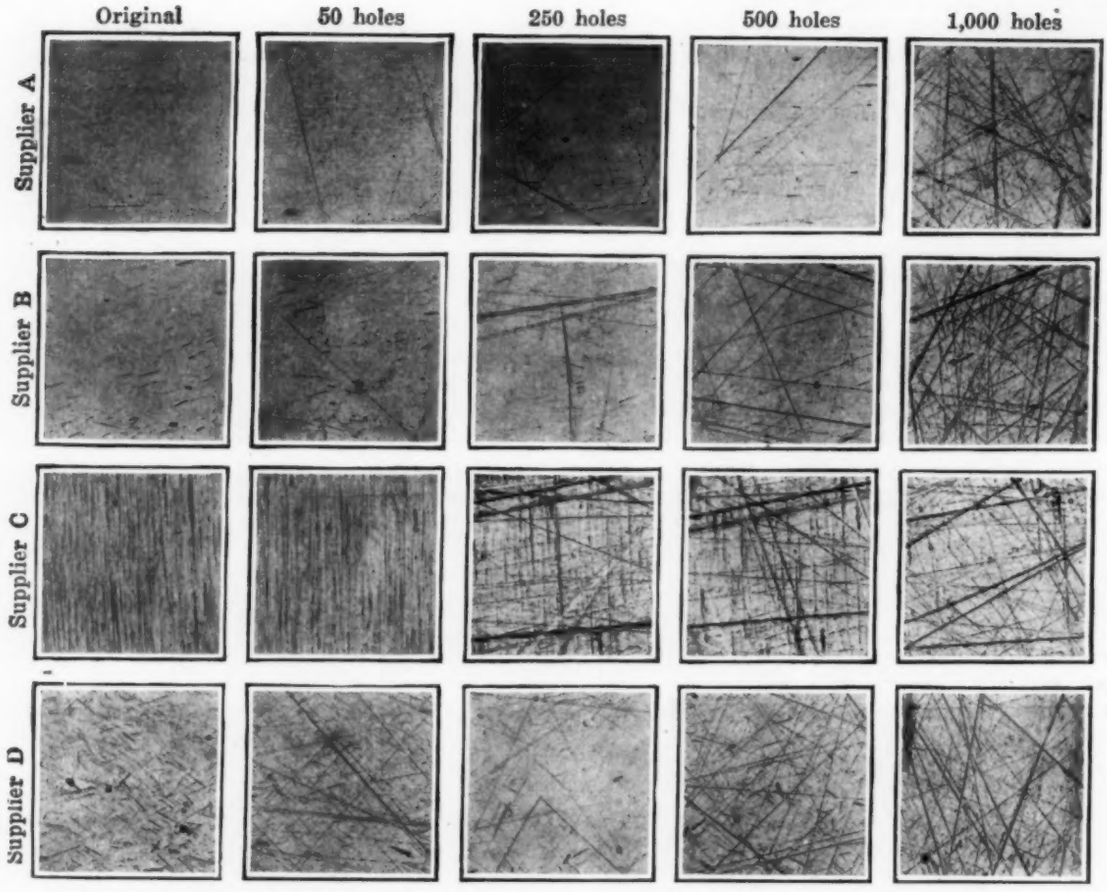



*Fig. 15—Comparative progressive wear of plug gages furnished by four manufacturers*

To ascertain further to what extent surface finish governed the wear life of plug gages, two mechanically-lapped gages 0.3745 in. in diam. were selected that had given an exceptional wear life on test. These were made of different steels but had the same hardness and surface finish. They were re-finished to 0.373 in. by careful hand-lapping so as not to affect the hardness and were again run on test.

The analysis and the number of holes per 0.0001 in. of wear plugged by each is shown in tabular form to the right. The comparative increase in life is quite marked, particularly in the case of the alloy-steel gage, when a mechanically-lapped finish is used instead of a hand-lapped one.

| Alloy Steel | | High-Speed Steel | |
|---|---|---|---|
| Element | Per Cent | Element | Per Cent |
| T. C. | 1.10 | T. C. | 0.64 |
| Mn. | 0.40 | Mn. | 0.41 |
| S. | 0.026 | S. | 0.015 |
| P. | 0.015 | P. | 0.015 |
| Cr. | 0.38 | Cr. | 3.495 |
| Va. | 0.03 | Va. | 0.515 |
| W. | Trace | W. | 17.46 |

| | Alloy | H. S. |
|---|---|---|
| Mechanically-lapped finish; holes per 0.0001 in. of wear | 11,882 | 10,155 |
| Hand-lapped finish; holes per 0.0001 in. of wear | 5,555 | 6,521 |
| Percentage of gain of mechanically-lapped over hand-lapped | 113.9 | 55.7 |
| Average per cent of gain for the mechanically-lapped finish | 84.8 | |

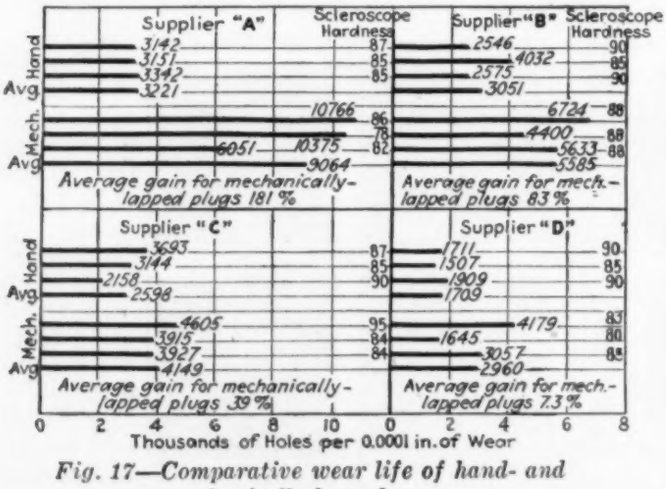

Supplier "A"
Scleroscope Hardness
Supplier "B"
Scleroscope Hardness
Hand Avg.
Mech. Avg.
Average gain for mechanically-lapped plugs 181 %
Average gain for mech.-lapped plugs 83 %
Supplier "C"
Supplier "D"
Average gain for mechanically-lapped plugs 39 %
Average gain for mech.-lapped plugs 7.3 %
Thousands of Holes per 0.0001 in. of Wear

*Fig. 17—Comparative wear life of hand- and mechanically-lapped gages*

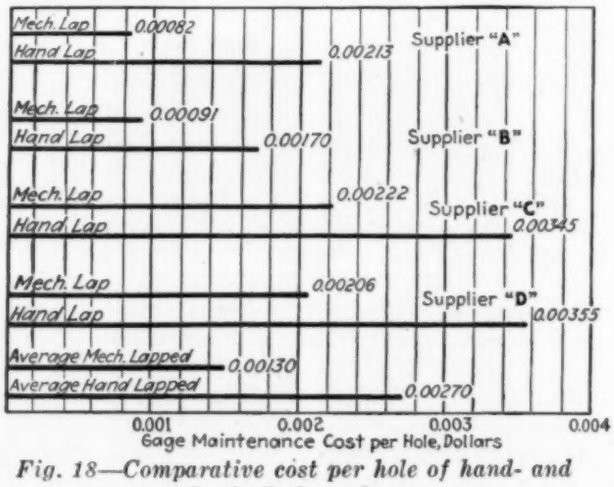



*Fig. 18—Comparative cost per hole of hand- and mechanically-lapped gages*

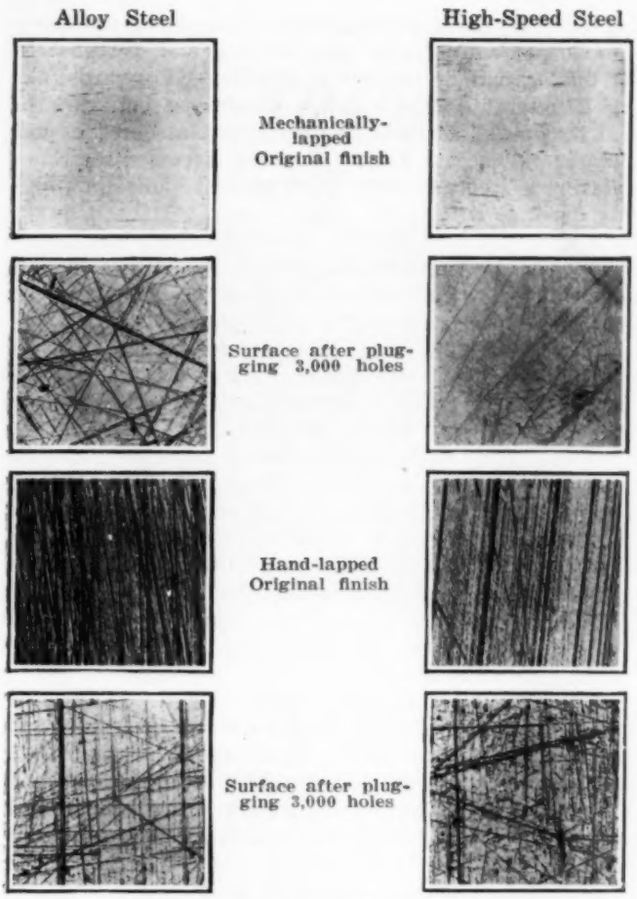



*Fig. 16—Comparative progressive wear of gages made of alloy and high-speed steel*

The microphotographs in Fig. 16 show the surface finish of both gages and both finishes. Note that the high-speed steel gage when hand-lapped had a better surface finish and gave a better wear life, where on the previous test with equal finish it had less wear life.

The chart in Fig. 17 shows a comparison of wear life between the mechanically-lapped and hand-lapped gages run on test from each supplier. In every case each supplier's mechanically-lapped finish gained over the hand-lapped finish. The percentage of gain was as follows:

Supplier A, average gain for mechanically-lapped finish—181 per cent.
Supplier B, average gain for mechanically-lapped finish—83 per cent.
Supplier C, average gain for mechanically-lapped finish—39 per cent.
Supplier D, average gain for mechanically-lapped finish—73 per cent.

The chart shown in Fig. 18 indicates the cost per hole based on 0.0001 in. wear of the mechanically-lapped and hand-lapped gages tested from each supplier. It is of interest to know that although the gages from Supplier A cost 42 per cent more than gages from Supplier B, the better finish of the gages from Supplier A resulted in a lower cost per hole. However, price does not always govern quality, as the gages received from Supplier C cost 75 per cent more than the gages received from B, but were of inferior quality, gave less life than either of those received from Suppliers A and B and cost more per hole.

We regretted that Supplier D did not replace its gages when notified that the gages furnished contained many grinding checks. We feel certain that these gages, minus this defect, would have made a much better showing in wear life and cost.

It is only fair in proving the worth of the investigation to show the results in actual practice and for this purpose is tabulated below a report covering one year's gage maintenance cost. The introduction of the favorable practices revealed by the investigation occurred in February. The percentages for the months following January were computed on the basis of the January cost, that is, considering January as 100 per cent, and from that period a decided decrease is shown, which substantiates the results of the test.

| Month | Maintenance Cost Per Cent |
|---|---|
| January | 100 |
| February | 87 |
| March | 94 |
| April | 78 |
| May | 67 |
| June | 45 |
| July | 43 |
| August | 40 |
| September | 49 |
| October | 52 |
| November | 53 |
| December | 35 |
| Average for the eleven months | 58.4 |
| Average decrease | 41.6 |

A tabulation of the cost of the past eight months of this year indicates an even greater decrease as follows:

| | Per Cent |
|---|---|
| Average maintenance cost for the eight months | 14.6 |
| Average decrease | 85.4 |

These results indicate beyond doubt how worthwhile their investigation proved itself.

## Musings of An Old Timer

A MACHINIST has as much privilege to be a gentleman as a preacher, a doctor or a lawyer; courtesy works like machine oil, try it once.

The task is the important thing, whether you hold a job or a position.

Thousands of dollars are wasted every year through useless talk; know what you are about and get busy.

It's a big mistake for a mechanic to try getting by on a bluff.

A clock watcher makes a poor fit in any machine shop.

Unnecessary work is a waste of time; try to do every job the easiest and quickest way.

Fancy frills on machine work went out with the flood; if the customer wants to pay for them, all right.

The machinist or toolmaker who says "it can't be done" generally wakes up when he sees somebody doing it.

You'll never work yourself out of a job by using speed with discretion; chances are that the boss has another job waiting for you.

# Book Reviews

**Accounting for Value as Well as Original Cost.** One hundred and eleven pages. Published by the American Appraisal Co., Milwaukee, Wis. Reviewed by Ernest F. DuBrul, General Manager, National Machine Tool Builders' Association.

A silver dollar or a $10 gold piece coined this year is identical in weight, size and fineness with those coined in 1896—1913 and 1920. Over the counter today, they all pass at equal value. Neither one will buy any more or any less than the other regardless of the date of their coinage. So most of us are not interested in the date stamped on these coins. Their main interest to us is in the fact that with them we can buy other and more useful forms of property.

But because the gold pieces of these different years are all of equal present purchasing power, we get to think of them as equivalent measures of the value of the permanent or long lived property we bought with similar dollars in previous years. We say that prices of goods are high or low, and do not think of the actual fact which is that high prices measure low purchasing power of a given amount of gold, and vice versa.

But one who invested $1,000 in 1895, in a perfectly good safe bond running 25 years bumped into a very unpleasant fact when the face of the bond was paid him in 1920. He found that his $1,000 had lost about two-thirds of its purchasing power in the interval.

On the other hand, had this investor placed his $1,000 in real estate that was merely good enough to keep its actual relative value, without gaining in value over other real estate, he could have sold it in 1920 for $3,000. Then he would have thought that he had gained a profit, while in fact he would merely have gotten back the same purchasing power he had invested twenty-five years before.

So it is a very great delusion to think of cost in dollars alone as a standard of value for investments. Any year's dollars are real dollars only in the year in which they are spent for consumption goods. This fact has deluded thousands of business men, and particularly manufacturers who must invest a great deal of purchasing power in plant assets.

This delusion is fostered, to the great danger of manufacturers, by the majority of accountants. Most accountants maintain that their job is to account for the dollar marks on a set of books—regardless of the fact that those dollar marks may have long ago ceased to reflect properly the true facts of the values of the property that they are supposed to stand for. Such accountants persist in deluding their employers by considering all dollars as exactly equal, regardless of the actual purchasing power invested at a given time in long lived assets.

The consequence is that many a business shows a book profit although really suffering a loss—an impairment of its stockholders' physical capital property. Many another that is supposed from the books to be making a big profit, is really making quite a small profit on the present value of the stockholders' property.

Most accountants base their practice on the delusion that once a dollar mark gets on their asset accounts it means the same thing for all time, as it meant on the day of entry. Of course there are some accountants who do not suffer from this delusion and, fortunately for business, their number is growing. Forward looking accountants and business executives both realize that they must dissipate this delusion that obscures and distorts the actual facts. So they arrange their accounting systems to show acual present values of property used, as well as the original cost.

They do this because they know that if a manufacturing concern is to stay in business, it must collect enough dollars from its customers to replace the physical plant used up in production of the goods it sells. They know that merely transferring dollar marks on books means nothing. If the business does not collect and reinvest proper depreciation, its stockholders simply have that much less physical capital with which to do business. Therefore the better accountants measure depreciation from replacement costs and not from cost of acquisition.

Only in this fashion can they tell whether the business is earning a real profit or suffering a real loss. Only in this way can they tell how much the real loss or gain may be. And only in this way can they tell whether their price structure squares with cold facts or is based on a delusion, fostered by accounting that shuts people's eyes to actual facts.

It is probable that most of the long lived assets of manufacturing businesses would average over fourteen years of age at this time. Therefore it is likely that average cost of acquisition would hit somewhere around the 1913 level of purchasing power. But the present cost of factory buildings and equipment is about twice that of 1913. So it is evident that the mere "dollar mark" method of depreciation accounting is taking only about half as much depreciation into cost as is necessary to replace the property.

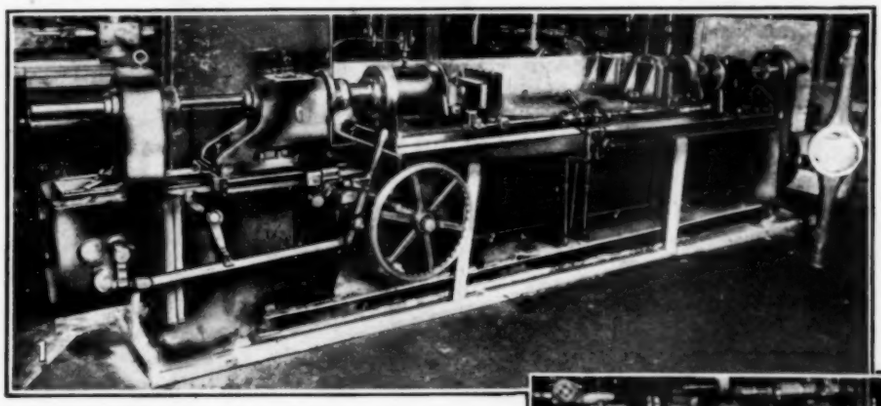
The booklet recently issued by the American Appraisal Company, under the title "Accounting for Value as Well as Original Cost" should be studied by every thoughtful manufacturer. It tells in a few pages, not only why the asset and depreciation accounts should be kept in this fashion, but it outlines a practical procedure for carrying out the accounting necessary to do this. If every manufacturer of machinery were to follow the recommendations in this book, some of them would learn that the true cost of depreciation of their plants is far greater than their accountants now lead them to believe.

**Standards Year Book 1927.** Three hundred and ninety two pages, 9x6 in. illustrated, cloth-board covers. Published by the United States Department of Commerce. For sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price $1.

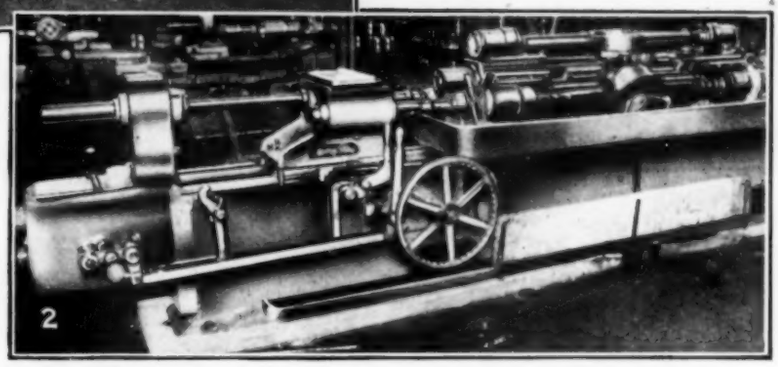
This work, the first of its kind compiled by the National Bureau of Standards, contains a review of the trend of standardization during the 25 years of the bureau's life. An historical sketch of the organization itself is given, as well as an outline of the activities of the various standardizing agencies throughout the world. All the fundamental standards of the United States are described and illustrated. The connections of the bureau with other governmental departments and its relations to science, commerce, and industry are presented.

To engineers, manufacturers, officers of societies, purchasing agents, or anyone concerned with standardization, this book will prove valuable.

# *Automotive Production*

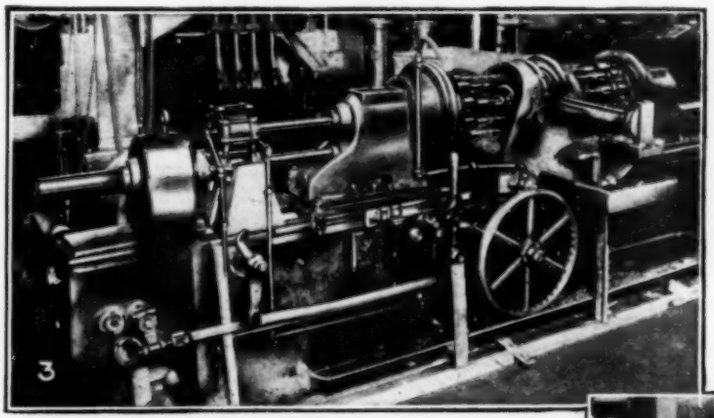


1—Rough boring ends of rear axle housing. R.p.m. of tool 160, cutting speed 150 ft. per min. Eclipse four-step counterbore. Sizes 3.500, 3.063, 2.521, 2.406 in. Feed 1¾ in. per min.—0.011 in. per rev. Work cycle 50 sec. Load and unload 35 sec. Total 1 min., 25 seconds. Duplex W. F. & John Barnes double end boring machine, 7½-hp., 1,200-r.p.m. motor.

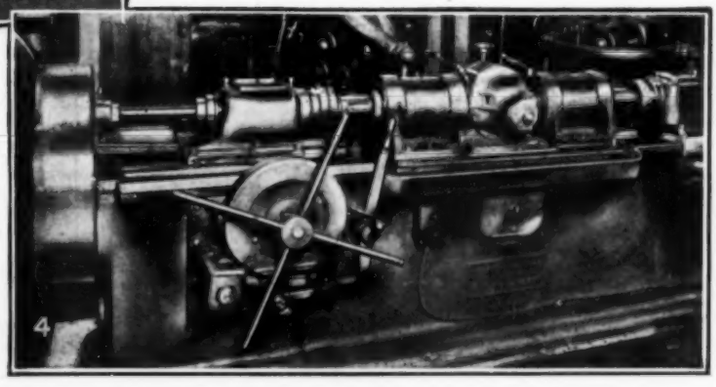


## Rear-Axle Drilling *in the Chrysler Plant*

2—Finish boring and reaming rear axle housings (both ends). Three-station fixture. R.p.m. of tool—Finish bore, 110; Finish ream, 55. Kelly Insert boring tool. Barber-Coleman reamer. Boring tool, 3.115 in. Reamer, 3.1255 in. Speed of tool—Bore, 90 ft. per min. Ream, 45 ft. per min. Feed, 1⅛ in. per min. Feed bore, 0.01 in. per rev. Ream, 0.02 in. per rev. Work cycle, 1 min. 35 sec. Load and unload while machining. Similar machine, similar motor. Three-station fixture.

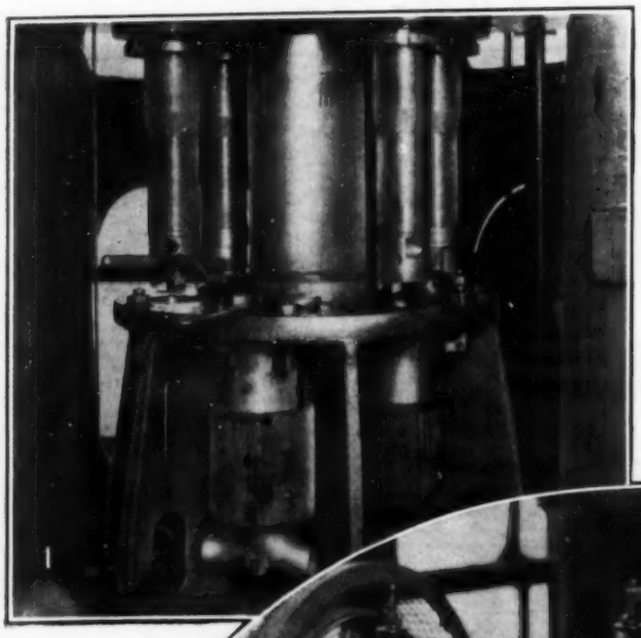


3—Drilling 20 holes in banjo face of rear axle housing with Krueger multiple drill head. Drill (0.332 in.) h.s. Speed, 70 ft. per min. Feed, 1.31 in. per min. Work cycle, 30 sec. Load and unload, 20 sec. Total 50 sec. Similar machine, similar motor.



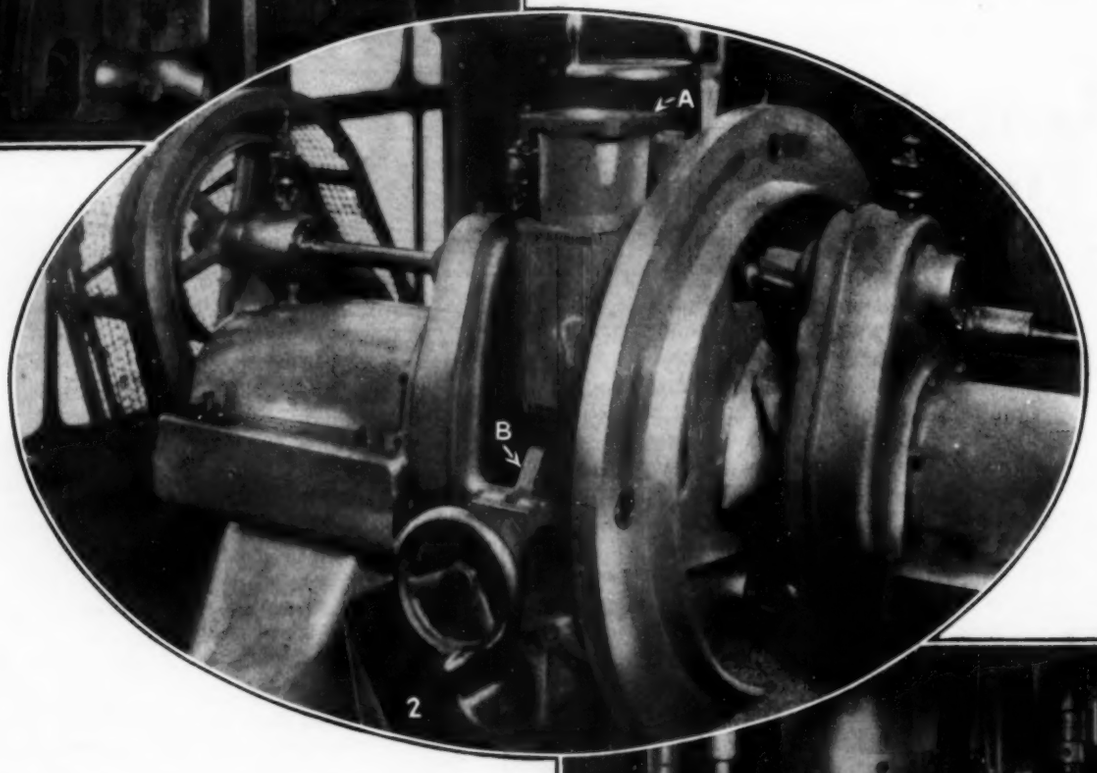
4—Finish boring and reaming cross-holes in differential housings. Kelly boring and reamer bar, 3.316 and 3.326 in.; Speed of tool 90 ft. per min.; feed 1⅝ in. per min.; 0.018 in. per rev.; work cycle 1 min. 33 sec. Load and unload 27 sec. Total 2 min. W. F. and John Barnes special double end horizontal boring machine, 5-hp., 1,200-r.p.m. motor.

## *Automotive Production*



# *Franklin* Cylinder Methods

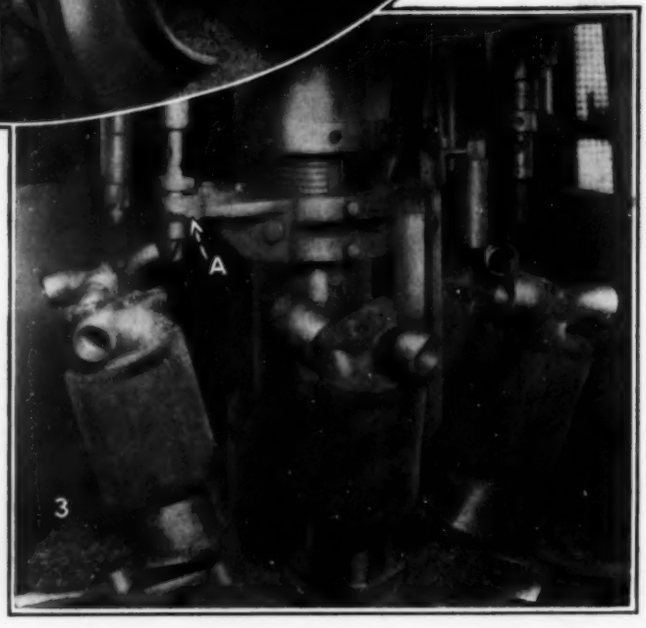
1—Special machine for boring cylinders
2—Machine for boring ports
3—Machining spark plug holes




FRANKLIN cylinder methods are in a class by themselves because of the fact that no other automobile engines now use separately cast cylinders. This difference affects not only the machining but the handling problems as well. After facing the flanges with relation to the bore, the cylinders go to the special machine in Fig. 1, where five cylinders are bored at one setting, being held by the hook bolts shown.

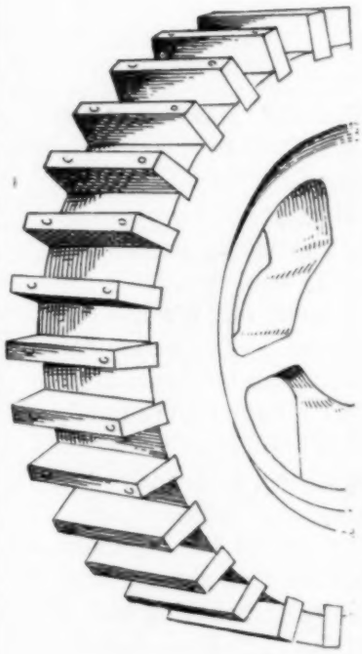
Another special machine that bores the opening in the cylinder ports, is shown in Fig. 2. The cylinders are located by dowels in the bolt holes *A* and are clamped by the screw and claw as at *B*, this being the loading position.

Locating again by bolt holes and using a swinging clamp, the spark plug holes are drilled, reamed, counterbored, chamfered and tapped on the Supermatic machine shown. The method of guiding the drill is shown at *A*.



# Gears

*by Loring Roper*



Gears—things that all machinery uses
Things that everyone abuses
Things with teeth around the rim
Sometimes fat and sometimes slim,
Things that everyone imagines
They can make.

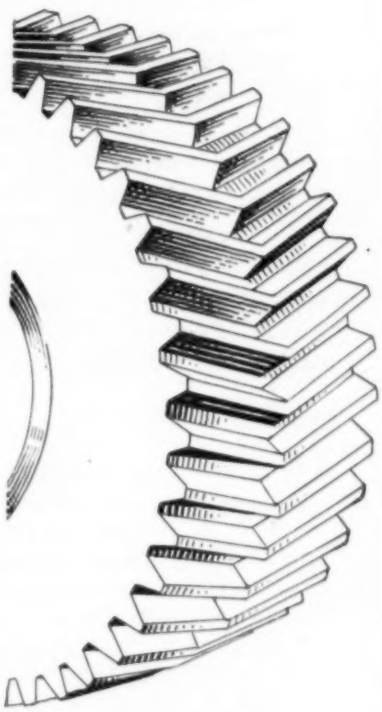
Used to be an easy matter
Didn't mind a bit of chatter,
Then a gear with lots of noise
Didn't rob life of all joys.
'Twas no trick at all to cut 'em
As they did.

Now, gee whiz, it's different quite
Gears now have to be just right.
Even spacing, teeth O.K.,
Form, addendum, every way.
It's some trick to make 'em now
As they should.

Old time gears don't go these days,
Must be made in better ways.
New machines and all the rest
If you want the gear that's best,
Have to go to those who know
How they're made.

Only those who know just how
Can make gears pass muster now.
They can make them cheaper, too,
Save a lot of cash for you.
They can show it doesn't pay
To make your own.

When the next job comes your way
Send it out without delay
To the shop with special training
So you both will share the gaining.
Gears today take expert making—
Use the best.



# THE · FOREMAN'S · ROUND · TABLE

## *Is the Company Picnic a Good Thing?*

*The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared*

"I'D RATHER work, Al. Every year it's the same thing—big job getting the family ready, crowded train full of yelling kids, a hot day, games that make people sore, physically and mentally, rain in the afternoon, too much food for the old people and too much pop for the kids, get home late and get up early the next morning. Then rush around at the shop for a week to catch up. No Company picnic if I had my way."

"That's a long speech for you, Ed. Accept my congratulations. Now have you looked at the good points?"

"I've looked for them, but not at them. What are they?"

"Wasn't it at the Company picnic you found out that White is a regular fellow as well as a vice-president? And didn't you change your opinion of our follow-up man after you played baseball with him at a Company picnic? And how about your checker, Smith? Guess he considered you weren't such a bad sort after your bridge game—no more trouble with him, eh? How about the change for the women? And the fun for the kids? How about the young fellows and the girls? Dancing, rowing, picnic lunches, are just as attractive to the young people now as when you were a kid."

"Oh, I knew you'd make out it's the real thing, Al—and I suppose you're more than half right. My wife puts up the same arguments. Says that after all we're a big family here in the shop and it'll make us a happier family if we play together a little instead of doing nothing but working together."

"Now I'll take your side of the argument awhile, Ed. I'm not sure that the majority want the picnic, in spite of believing that it is, or can be, a good thing. I believe that the Company should take a secret ballot on it, and act accordingly—not just set aside a day and say, 'There'll be a picnic.'"

"I believe you've hit it, Al! Maybe not being asked is the psychology back of my objections. I'm going to take it up with Williams."

*Is the Company picnic a good thing? Why or why not?*

*Who should decide whether or not there is to be a picnic?*

*Granted that people should be able to work together on a basis of fair dealing and mutual understanding without social get-togethers, is it in human nature to do so?*

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

# Discussion of Earlier Topics

### Advantages of Foremen's Clubs

GOING back over an experience of seven years as a member of an active foremen's club, I believe it has been valuable, not perhaps from a financial standpoint, but from the fact that in our meetings we have discussed problems to the mutual benefit of all. We are better foremen because we have gotten an entirely new viewpoint on our duties and responsibilities.

We have a foreman's club in the city with a membership of about 50 representing 16 different industries, and it functions as an educational gathering, meeting once a week for study, with a dinner about once in six weeks. This winter we have studied the starting of a new business, carrying it through the various steps including finance and cost methods. The instructors were recruited locally, each one taking four evenings and one general subject. The first group was handled by the vice-president in charge of production of a machine company employing about 800 men, eight subjects were covered dealing with the work of the foremen. The second four evenings were handled by the superintendent of a public utilities corporation, and covered materials and their handling. The third division was handled by the president of a heating and ventilating corporation, and the subjects discussed related to equipment. The fourth part of the course of study was given by the general manager of the local factory of one of the large automobile firms, and dealt with organization and management. This outline will show why we believe our club is successful. The co-operation we have had from the volunteer instructors, and the type of men who have given their time to this work shows that they believe we mean business.

—R. G. DICKENS.

### Arguing with the Big Boss

I AM of the opinion that a foreman should not go against his better judgment unless he has definite orders to do so from the "Big Boss," or until he has called it to the attention of the latter before starting the job.

A foreman, if he is of the right type, has learned to use diplomacy in handling his men, and there is no reason why he should not apply the same tactics in approaching the "Big Boss." Arguing is all wrong anyhow, and he should not start in by explaining in detail, but rather with a broad statement of what he proposes to do.

There is the additional fact that on the previous decision, the "Big Boss" may have been guided by factors entirely foreign to the shop situation, which he was not at liberty to disclose, and which the foreman was not in a position to understand. Therefore, drawing a general interpretation of the attitude of the Boss from a single incident is often contrary to the general policy of the "Big Boss" himself, and is entirely unfair to him.

—PHILIP H. HOELZLE.

ALL arguments are not won on the merits of the arguments presented, but often on the superior ability of one person to express himself forcefully. It is sometimes very evident that it is possible to use this ability to an unfair advantage, especially when dealing with shop men.

An argument with the "Big Boss" should mean a presentation by the shop man or shop foreman, of clear, logically arranged facts, the nature of which he has a much better opportunity to become acquainted with than the executive has. The perspective of the shop man is quite different, sometimes, from the perspective of the "Big Boss," and if wise, accurate decisions are to be made, the "Chief" must not only welcome, but encourage, these arguments with the shop men.

Arguing with subordinates, whether about methods of manufacture, cost, or personnel, creates an incentive for the shop man. He believes his ideas are worth something, and if allowed to express these ideas and opinions he naturally becomes more interested. He soon finds upon presenting his arguments that there are many sides to the problems discussed, and that all these different sides must be considered before a decision is made. He commences to study the problems, and good wholesome enthusiasm is the result. An executive who is wise enough to discuss the problems of the shop with his men will soon have around him an intelligent, interested, enthusiastic group of men striving for the highest degree of perfection in the shop.

—CHARLES H. GODSCHALL.

INASMUCH as the foreman is generally concerned with methods, I believe it is not only his right, but his duty to point out where he differs with the Big Boss. For the same reason it is up to the Big Boss to give the foreman a reasonable hearing. Having presented his facts, not his prejudices, to the Big Boss, it is distinctly the foreman's duty to carry out his orders, whether he agrees with them or not. To accept orders blindly, without stating objections in a clear and concise way, is as bad as arguing excessively.

—JAMES P. CONNOR.

## THE · NEXT · TOPIC

***Should the Shop Govern Purchases?***

QUESTIONS

*Should the shop or the purchasing department designate the class of material to be purchased?*

*Does money saved in the purchase of materials always stay saved in the shop?*

### More About Discipline in the Shop

I DO not agree with J. W. Conrad on page 423, Vol. 66, of the *American Machinist*, in regard to breaking men. In most shops today the term would certainly indicate a bad case of swelled head on the part of the foreman. We do not want to break men as was sometimes done years ago, but we want to educate them so that they will have confidence in us.

I have seen broken spirited men, and I do not want to see one again. They are like the broken spirited animal with head down and fear in its eyes. No production man wants the men to "rush" on his approach. He knows that soldiering will take place the moment his back is turned on such men. The official who has a cheery "good morning" and a word of praise occasionally will win the respect of the men. There never was a driving, man-breaking foreman who ever made a success in his department. —C. G. WILLIAMS, *M.E.*

### Who Should Do the Discharging?

AS A shop foreman of more than forty years' standing, I do not agree to any hard and fast rule as to who should do the discharging. Whether it is advantageous to transfer a man depends on variable and totally dissimilar circumstances, so that no fixed rule is possible.

Let the employment officials engage the men. The foremen then tries them out. If suitable, these men are kept on, and those unsuitable are reported to the employment office for discharge. The question of the transfer of discharged men is outside of the shop foreman's jurisdiction, and is for the employment staff to deal with.

The foreman's task is to keep his own shop well supplied with the best men, and if he gives attention to that, he will have no time to bother as to whether a sacked man is transferred or not. Of course, I am leaving all sentiment out of the question, for when such comes in, all rules, regulations, written or unwritten, go by the board. —J. L. TOWLSON, *England.*

I AM of firm opinion that the foreman should have the power to discharge his own men, but in every case where a firm has an employment department, the man's discharge certificate should be sent there, so that a complete record of his services can be kept, and he can be allocated to another department, if in the foreman's opinion the man may be employed again. The interchange of men from department to department increases their knowledge of the product, and makes them realize the importance of keeping work to gage sizes. —C. L. HENRY, *England.*

### Why They Decided Not to Use a Jig

IN DECIDING whether or not to use a jig, one must be governed by the following considerations: How many pieces are there to drill? What limits are allowed? Are the pieces likely to be ordered again?

Certainly 150 pieces do not warrant an elaborate jig, but if Jack could have a drill plate for marking out the centers, then this plate ought to have been used as a drill guide. It is well known that the center punch mark is a guide only for the drill point. It does not prevent the drill from running out of center. For this reason each hole would have to be marked with a circle and means provided to keep the drill centered within these marks. The marking and not the drilling would take up time.

Surely this job did not warrant an aluminum fixture, but a simple jig plate was needed.

Since Jack said he had drilled some of these castings before in smaller lots, it seems that they were ordered at various times. This again would indicate that the center-punch method is wrong. The question of repeat orders requires careful consideration when deciding whether or not to make up special fixtures.

—SCOTT FORTUNE, *England.*

### The Practical Joker

OF WHAT use is it to display safety-first posters to warn the men of the dangers of the work in the shop if practical joking, which increases the danger, is to be countenanced? Then, there is the question of the effect the joke has on production. Through watching for the effect that the joke is going to have on the intended victim, the men cannot give their attention to their jobs, and so production must suffer. As for the victim, his output may fall off for the remainder of the day.

Al wasn't a bit too severe on the new man. It is the duty of foremen to have their departments operating as efficiently as possible. To do this they must eliminate those factors that are detrimental to output. Practical joking in the shop is one of these factors, and must not be tolerated. —JAMES C. HARPER, *Scotland.*

### Who Should Go to the Storeroom?

THE ideal shop would be one in which every high-priced mechanic would not have to leave his work. Eliminate the walking around and you are going to increase production and profit too. However, in locomotive repair shops, this is almost impossible. The runner system has its limitations and faults. In a small shop, that is confined to one or two buildings, the runner system is not necessary. In large plants, working on new and standardized work, the runner system works out very well.

The writer has worked in railroad shops that employed various systems and the one that seemed to work out best was to have a runner for each gang, although in some cases it was necessary for the mechanic to go to the stockroom or tool crib.

In some plants handling new work all parts are given a serial number and each operation is numbered. When a job is assigned to a man, he sends his runner to the toolroom with the corresponding number and the toolroom man, from his chart, supplies all necessary tools or jigs for the given job number. This applies to either bench or machine operations.

Another system is to have the foreman do the ordering of tools in time to have them on the ground when the man is ready to start the job.

The runner system gives the foreman an opportunity to plan his work ahead and eliminates much of the walking back and forth of his men.

—WALTER E. SHANNON.

# Ideas from Practical Men

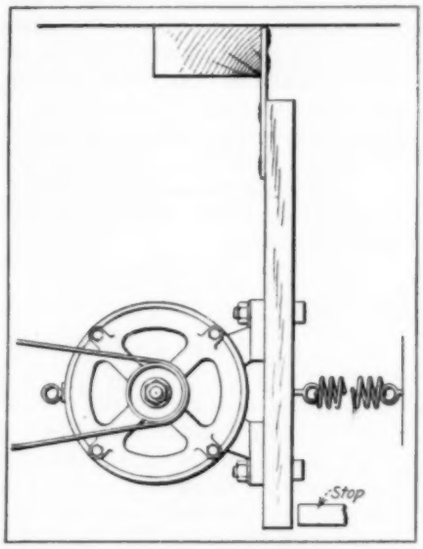
**The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit**

## A Method of Quieting Motor Noise

BY DEXTER W. ALLIS

Small electric motors running at high speed make a humming noise that is very annoying, especially if the motor is operating in an office or drafting room.

A great deal of the noise can be eliminated by mounting the motor on a yielding support, such as shown in the illustration. The support should be hung on sound-insulating hinges, preferably of leather or rubber. A coil spring, one end of which is attached to a fixed support, such as the wall or a post, while the other end is fastened to the back of the motor mounting in line with the belt, will tend to keep the belt tight. While the weight of the motor alone would probably give the necessary belt tension for a light drive, more quiet operation will result when most of the pull is taken by the spring. Back of the motor support there should be a stop to prevent undue swing of the motor in case the belt should come off or break.



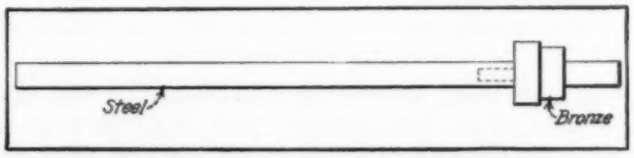

*Motor mounted to eliminate noise*

## A Lathe-Center Knockout

BY EDWIN KILBURN

The lathe-center knockout shown in the sketch is simple, easily made, effective and cannot damage the spindle bore, collet or lathe center.

The body is of steel, one end being bored to receive the bronze head used in removing the center or collet.




*Knockout that will not cause damage*

One end of the bronze head is made a press fit in the steel body and the balance is turned to three diameters, the largest or guiding portion being $\frac{1}{32}$ in. smaller than the spindle bore. The part adjacent to this is turned $\frac{1}{16}$ in. smaller than the spindle bore, while the end projection is finished $\frac{1}{8}$ in. less in diameter than the small end of the lathe center.

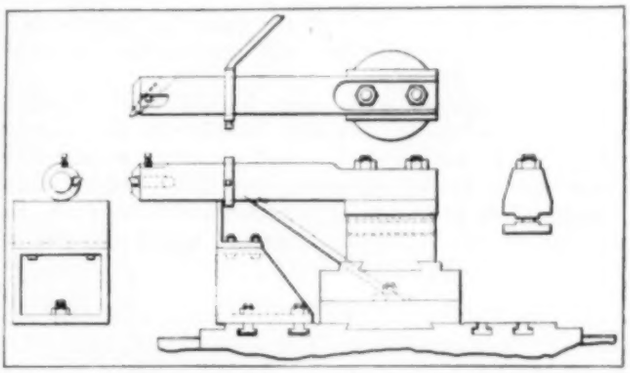
This tool will remove the most stubborn center or collet with no possibility of damage, even though a very heavy blow is necessary to start either of them.

## A Special Boring Rig

BY S. B. RICHEY

We recently had a number of cast-iron flanges, of 31 in. outside diameter, to bore to 24 in., face, and drill. Since our lathe would swing only 30 in., it was necessary to cut $\frac{3}{4}$ in. out of the corners of the ways. This necessitated the construction of a boring bar that would reach out over the end of the carriage far enough to bore through the flange before the end of the carriage would come into contact with the flange. It was also required that the same tool could be used for facing the flange without any change, except in the cutter bit. The bar was made as rigid as possible on account of the heavy cuts to be taken. The sketch shows how it was supported.

The bar was made as shown in the drawing. It is 24 in. over all, 3 in. in diameter and was welded to a mild steel block, $1\frac{1}{2}$ x 4 x 7 in., the block being machined to fit the toolpost slot. Another similar block having two $\frac{7}{8}$-in. studs screwed and riveted into it was likewise fitted to the slot.



*Bar for facing and boring flanges*

With the type of bar in which a sleeve screws on to the end to hold the bit, it is necessary to adjust the bar for each different sized bit. With the type illustrated,

variation in the size of the bits makes no difference and a number can be ground at a time, or one can be ground while another is in use. Another advantage is that the bit is supported very close to the cutting point.

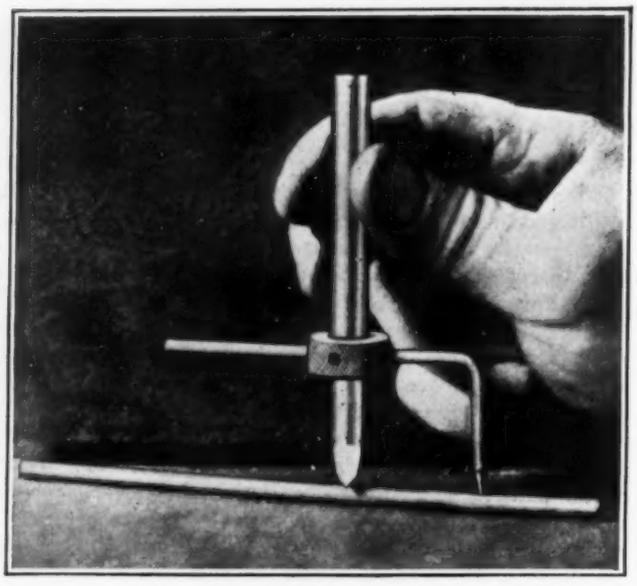
In machinging these flanges, a bit was ground square across the end to hog off the corner of the flange so that the bit used for boring had clean iron in which to start the cut. The bit for boring was ground to an included angle of about 45 deg. with the point rounded to a radius of $\frac{1}{16}$ in. The bits were $\frac{3}{8}$ in. square high-speed steel.

## Gage Attachment for a Chisel

By Arthur Kendall

When a number of pins of small diameter are needed we break them off the wire rod instead of sawing. To quicken this operation a simple little sliding gage, adjustable for any length, was made for the chisel.

The complete device, shown in the illustration, consists of the chisel itself, a knurled collar, and the slide gage. The latter is bent over and sharpened to a chisel



*Length gage in use*

point at the end. The knurled collar is tapped for a small setscrew so that the sliding gage may be tightened.

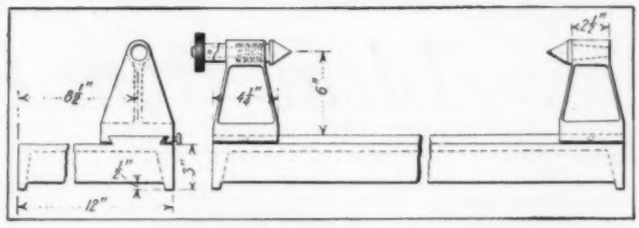
In operation the gage is set to the required length and the chisel is struck with a hammer in the ordinary way. Then the chisel is moved until the point of the gage enters the chisel mark, and the chisel is struck again. This procedure is repeated until the whole rod is marked off. Then the pins are rapidly broken off while the rod is held in a vise.

## Centers for the Inspection Bench

By H. L. Wheeler

A set of accurate testing centers for use by inspectors, or in the tool room, is a valuable accessory in many shops. Centers that are in common use on general machine work are not always suitable for testing and inspecting precision work, and it is for this purpose that the design shown in the sketch is intended.

The base can be made from an inexpensive pattern,




*Inspector's test centers*

or from a solid slab of cast iron, and to any suitable dimensions. The casting should be of fine-grained iron and should be allowed to season after rough planing. Machine work should be done with care and precision, especially if the work for which the centers are to be used must be held to close limits. All surfaces should be scraped to a perfect bearing. The head and tailstock castings can be made from the same pattern. To insure alignment they should be finish bored in place after the dovetails have been fitted.

The centers are made of tool steel, hardened and ground. The dovetails of the heads are provided with gibs and three gib screws. A thumb nut on the side against the gib, locks the setting of the member. One center is made so that it can be withdrawn without disturbing the setting of either head. This is accomplished by a simple cam arrangement and a coil spring back of the center. A half turn of the knurled wheel withdraws the center and holds it out, while another half turn permits the tension of the spring to return the center against the work.

## An Indexing Fixture for Cutting Gears

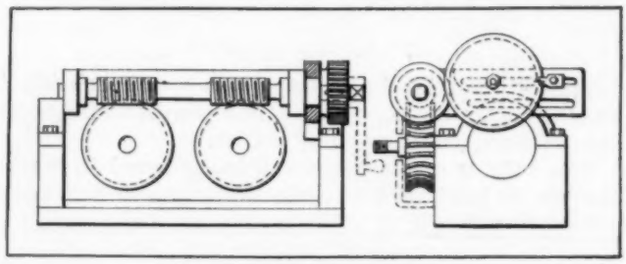
By P. W. Nielson

*London, England*

The sketch shows a fixture I made in our toolroom to enable me to cut gears up to 6-in. outside diameter on an old plain horizontal milling machine. All of the movable parts are carried upon a head that swings upon trunnions in the base casting so that the fixture is available to cut either plain spur or bevel gears.

Upon each of the two work-holding spindles, which are provided with No. 3 Morse taper holes to take the arbors upon which the work is mounted, there is a 40-tooth worm wheel, and both are driven by worms keyed to the transverse shaft to which the indexing wheel and the operating crank are attached. The method of indexing is by means of gears from the change train of any lathe.

The gear to be mounted on the worm-shaft must have the same number of teeth as is desired in the blank.



*A simple indexing fixture*

The idler wheel, mounted upon an adjustable stud in a suitably slotted arm to mesh with the first gear, is always a 40-tooth gear. It is obvious that when the 40-tooth gear has made one complete turn the work

spindles will have been moved through the distance necessary to space for one tooth upon the blank. A witness mark upon the rim of the 40-tooth gear and a fixed pointer on the arm as shown enables me to make the indexing movement quite accurately, as it is always one full turn of the gear, regardless of the division to be made upon the blank.

Almost any number of divisions may be spaced by this fixture. If there is a gear in the lathe change train with the required number of teeth, all that is necessary is to put it on the worm shaft and go ahead. An infinite number of other spacings may be obtained by compounding, as in cutting threads upon the lathe.

## Air Blast for the Punch Press —Discussion

By Arthur R. Myers

In an article by Alex. A. Curtis, under the title given above, published on page 28, Vol. 65, of the *American Machinist*, the device described is O. K., but it seems to me that it requires too much trouble in making and also in adjusting for use. The same is true of the device shown by Frank Waldo (see page 1073, Vol. 65) in his discussion of Mr. Curtis' article. I devised an air blast that is very simple to make and to operate. The sketches show the idea. The air valve is held securely to the press in such a position that the cam *A*, which is attached to the crankshaft, will operate the button of the air valve, as shown in Fig. 1. The length of the arc on the cam, determines the duration of the air blast in relation to the stroke of the press. A cam having sufficient length of arc will assure a blast during the entire up stroke of the ram, and a short cam will give a momentary puff.

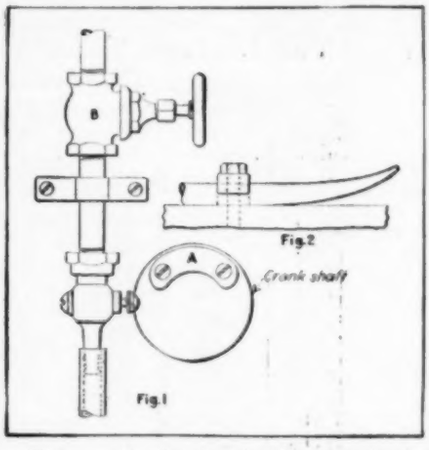



*Fig. 1—A simple air-blast control.*

*Fig. 2—Nozzle arrangement*

This arrangement is inexpensive and is suitable for all jobs. A nozzle similar to the one shown in Fig. 2 can be clamped to the die shoe and the hose slipped on. The valve shown at *B*, Fig. 1, is used to shut off the air when the press is idle.

## A Gage Chisel

By H. N. Tuttle

Recently it was necessary to enlarge four tapered square pockets in a metal pattern. Since extreme accuracy was not required, it was decided to do the work by chipping, filing and scraping, instead of machining. Fig. 1 shows one of the pockets which is about 1 in. square and $\frac{3}{8}$ in. deep and slightly tapered. It was desired to enlarge the hole about $\frac{1}{32}$ in. all around as shown by the dotted lines.

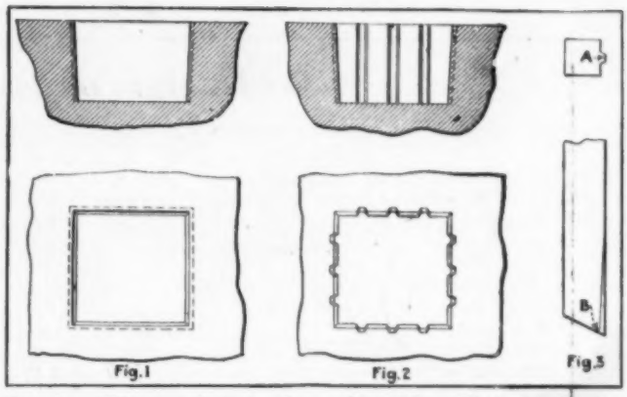



*Fig. 1—The pocket to be enlarged. Fig. 2—Pocket grooved by chisel. Fig. 3—The gage chisel*

It was thought that if several narrow grooves $\frac{1}{32}$ in. deep could be chipped down the sides as shown in Fig. 2, these grooves would not only make the remainder of the chipping easier, but would also act as a gage, indicating just how deep the cut should be made.

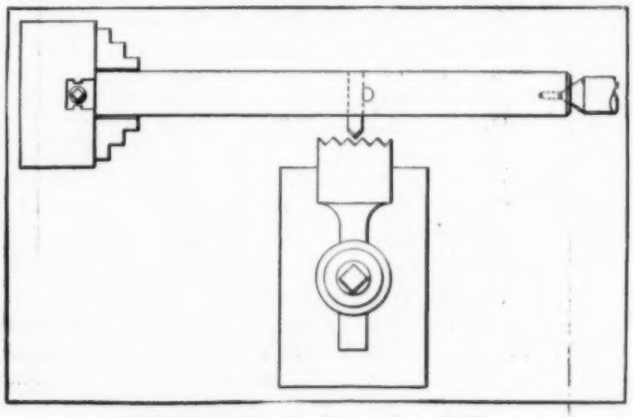
A cold chisel, Fig. 3, was made from an old square file and ground as shown on the corner of an abrasive wheel. The tongue *A* was first made a little deeper than $\frac{1}{32}$ in. and then, after making trial grooves with it, it was ground down to the right depth. The guides *B* were rounded off a little as shown to prevent them from cutting into the work. The subsequent chipping, filing and scraping were done in the usual way.

## Simple Way to Make a Thread Chaser —Discussion

By S. A. Burbey

*Bedfordshire, England*

The article under the title given above by Charles Kugler, published on page 844, Vol. 65, of the *American Machinist*, does not seem to me to show the most satisfactory method of doing this job. The tool he shows would have to be very short and stiff to avoid springing.



*Set-up to cut a chaser in a lathe*

I would suggest that instead of holding a tool in the chuck, supported at only one end, he substitute a standard boring bar as shown in the accompanying sketch. With one end of the bar supported by the tail center, the cutting tool will be much more rigid.

The sludge from acetylene generators has been found very satisfactory as whitewash for shop use. It is frequently used in the pits in railroad roundhouses.

# Design of Gear and Pulley Arms

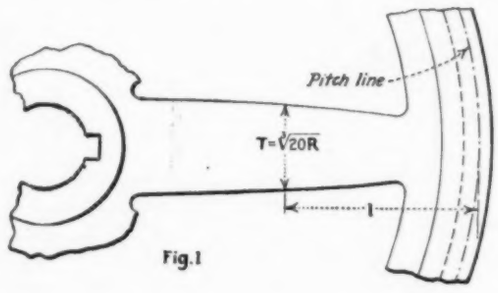


Fig.1

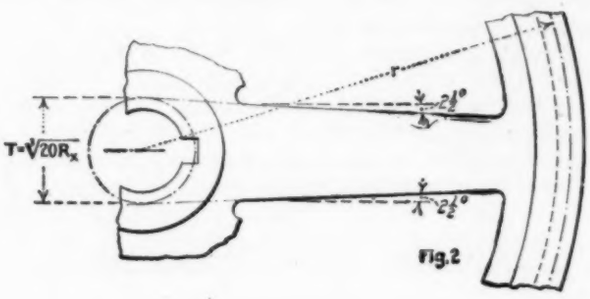


Fig.2

By means of the formulas and tables given, gear, sprocket or pulley arms can be proportioned to give the equivalent strength of the teeth and the rim.

$$R = \frac{W\,l\,c}{S_v\,n} \qquad (1)$$

Where $R$ = section modulus at distance $l$ in inches from the gear pitch line, as shown in Fig. 1.

$W$ = allowable tooth load, lb.

$S_v$ = allowable fiber stress, lb. per sq.in. (Table I)

$n$ = number of arms

$c$ = a constant = 2.3 for class A gears
= 3.0 for class B gears

Class A gears are for standard or average service and class B for rapidly-varying loads or where the drive is reversed or started and stopped often.

$S_v$ is derived from the modified Lewis formula

$$S_v = \frac{600 + S}{600 + v}$$

Where $S$ = max. static fiber stress, lb. per sq.in.

$v$ = per. velocity at pitch line, ft. per min.

Table I—Values of $S_v$ for Cast Iron, Lb. per Sq. In.

| V Ft. per Min. | Class A Service | Class B Service | V Ft. per Min. | Class A Service | Class B Service |
|---|---|---|---|---|---|
| 0 | 8000 | 6000 | 750 | 3550 | 2660 |
| 50 | 7380 | 5540 | 900 | 3200 | 2400 |
| 100 | 6860 | 5150 | 1050 | 2910 | 2180 |
| 150 | 6400 | 4800 | 1250 | 2600 | 1950 |
| 200 | 6000 | 4500 | 1450 | 2340 | 1750 |
| 250 | 5650 | 4240 | 1650 | 2130 | 1600 |
| 300 | 5330 | 4000 | 1850 | 1960 | 1470 |
| 400 | 4800 | 3600 | 2050 | 1810 | 1360 |
| 500 | 4360 | 3270 | 2300 | 1650 | 1240 |
| 600 | 4000 | 3000 | 2500 | 1550 | 1160 |

The shape of the sides of the arm as given in equation (1) is parabolic and hence difficult to produce. For this reason it is desirable to use a modified formula giving straight-line sides as follows:

$$R_x = \frac{W\,r\,c}{S_v\,n} \qquad (2)$$

Where $R_x$ = theoretical section modulus at axis of shaft and $r$ = pitch radius of gear, in.

The taper of each side is 2½ deg. or 5 deg. included angle of arm sides as shown in Fig. 2. The cross-section of the arm is readily amenable to the ellipse shape, Fig. 3, where the width is double the thickness.

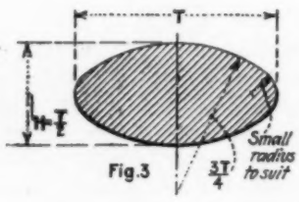
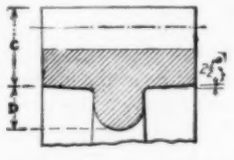


Fig.3

$R = 0.09875T^2H$
$= 0.057^3$ about
or $T = \sqrt[3]{20R}$

Table II—Section Moduli of Arms of Elliptical Cross-Section

| Size of Ellipse In. | Section Modulus In.³ | Size of Ellipse In. | Section Modulus In.³ | Size of Ellipse In. | Section Modulus In.³ |
|---|---|---|---|---|---|
| ¾ x ⅜ | 0.021 | 2¼ x 1¼ | 0.559 | 3¾ x 1⅞ | 2.588 |
| ⅞ x 7/16 | 0.033 | 2⅜ x 1 3/16 | 0.658 | 3¾ x 1 11/16 | 2.856 |
| 1 x ½ | 0.049 | 2½ x 1¼ | 0.767 | 4 x2 | 3.142 |
| 1⅛ x 9/16 | 0.070 | 2⅝ x 1 5/16 | 0.888 | 4¼ x2¼ | 3.768 |
| 1¼ x ⅝ | 0.096 | 2¾ x 1⅜ | 1.021 | 4½ x2¼ | 4.473 |
| 1⅜ x 11/16 | 0.128 | 2⅞ x 1 7/16 | 1.166 | 4½ x2½ | 5.261 |
| 1½ x ¾ | 0.166 | 3 x1½ | 1.325 | 5 x2½ | 6.136 |
| 1⅝ x 13/16 | 0.211 | 3⅛ x1 9/16 | 1.498 | 5¼ x2⅝ | 7.103 |
| 1¾ x ⅞ | 0.263 | 3¼ x1⅝ | 1.685 | 5½ x2¾ | 8.167 |
| 1⅞ x 15/16 | 0.323 | 3⅜ x1 11/16 | 1.887 | 5¾ x2⅞ | 9.332 |
| 2 x1 | 0.393 | 3½ x1¾ | 2.105 | 6 x3 | 10.603 |
| 2⅛ x1 1/16 | 0.471 | 3⅝ x1 13/16 | 2.338 | | |




| Constant | Class A Service | Class B Service |
|---|---|---|
| y | 3.875 | 4.375 |
| z | 2.500 | 3.000 |

Table III—Rim Proportions, Inches

| Diametral Pitch P | $C = \frac{y}{P} + \frac{1}{16}$ in. | | $D = \frac{z}{P}$ | |
|---|---|---|---|---|
| | Class A Service | Class B Service | Class A Service | Class B Service |
| 2 | 2.00 | 2.25 | 1.25 | 1.50 |
| 2½ | 1.61 | 1.81 | 1.00 | 1.20 |
| 3 | 1.35 | 1.52 | 0.83 | 1.00 |
| 4 | 1.03 | 1.16 | 0.63 | 0.75 |
| 5 | 0.84 | 0.94 | 0.50 | 0.60 |
| 6 | 0.71 | 0.79 | 0.42 | 0.50 |
| 7 | 0.62 | 0.69 | 0.36 | 0.43 |
| 8 | 0.55 | 0.61 | 0.31 | 0.38 |
| 9 | 0.49 | 0.55 | 0.28 | 0.33 |
| 10 | 0.45 | 0.50 | 0.25 | 0.30 |
| 12 | 0.39 | 0.43 | 0.20 | 0.25 |

Contributed by R. D. Pinkney, Chief Engineer, H. R. Smith Machine Co.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# Technical Abstracts

## Refinish Locomotive Parts with Precision Abrasive Tools

A survey of operations at any one of a number of leading railroad repair shops indicates a steadily increasing application of grinding to locomotive rebuilding and repair work. Some shops, as may be expected, have facilities for certain jobs that others have not; yet a general average shows advancement. Perhaps the past year has seen more in the installation of abrasive equipment in locomotive repair shops than any thus far, reflecting not only a growing appreciation of the work that can be accomplished by grinding, but possibly, too, the improved financial status of the carriers; and if the increased equipment budgets for this year can be taken as significant, 1927 should see an even greater volume of grinding equipment purchased by the railroads.—B. K. Price, *Abrasive Industry*, May, 1927.

## The Northern Pacific 4-8-4 Locomotives

Twelve locomotives of the 4-8-4 type equipped with trailer boosters have been ordered by the Northern Pacific, one of which has been delivered. These locomotives will develop a tractive force of 57,500 lb. without the boosters. The boosters will provide an additional 11,400 lb. The boilers carry a pressure of 210 lb., but are designed for 225 lb. The cylinders are 28 x 30 in. A trial run with the first locomotive showed that it could haul nine steel passenger cars up a 2.2 per cent grade, and eleven cars of the same type up a 1.8 per cent grade without a helper, at sufficient speed to maintain the schedule.

While the fire box and grate areas have been made very large to burn low-B.t.u. coal, it is the intention to reduce the grate area from 115 to 95 sq.ft. when burning a better grade of coal. To reduce the grate area, a temporary brick wall will be built on the grate bars in the front end of the firebox. The long overhang at the rear end, necessitated by the large firebox, make it necessary to use a four-wheel trailer truck to carry the weight.

The stoker engine will be located on the tender to relieve the rear end of the locomotive of weight. Steam distribution will be controlled by the Baker valve gear, designed for 87 per cent maximum cut-off, and a Precision reverse gear. The cylinders are to be steel castings and all steam cavities are to be self draining. The stoker engine, dynamo, booster, blower and air compressor will be operated with superheated steam.

The total weight of each engine will be 426,000 lb., of which 260,000 lb. will be carried on the drivers; 62,000 lb. on the front truck; and 104,000 lb. on the trailer truck. All of the hubs of the driving and trailing wheels will have adjustable hub liners made of gun iron. The back ends of main rods will have floating bushings, working in gun-iron bushings pressed into the rods.

Each locomotive will be equipped with an exhaust-steam ejector; a multiple-disk throttle valve built into the superheater-heading casting; cut-off control gage; speed indicator; and ratchet-type flange oilers. — *Railway Age*, April 23, 1927.

## Knurling for Light Press Fits

Knurling can be used to advantage in the manufacture of many classes of light mechanism in which small stampings, pinions, or similar parts must be assembled on their shafts by pressing the parts together. The advantage of knurling is that it raises ridges, or points, and thus increases the shaft diameter sufficiently to allow for larger limits between the shaft and hole diameters than would be practicable if the parts were pressed together without knurling, the bearing surfaces being plain.

Furthermore, the knurling method of assembling light parts tends to avoid the cracking of hubs, bushings, etc., which might occur in assembling plain bearing surfaces, assuming that ordinary production limits are allowed. There are various kinds of knurled surfaces, but the plain, or straight, knurl is the kind commonly employed in connection with press fits.—J. K. Olsen, *Machinery*, April, 1927.

## A Successful Trade School

The Ford trade school, which has been functioning at the Highland Park plant of the company for the past 10 years, has been opening the door of opportunity to thousands of boys, and also making it a profitable venture for the company. At present it has an enrollment of 1,800, and a waiting list of 4,000. The staff of instructors is approaching the 150 mark, and the school covers an area of 3 acres.

The school was started with 6 boys and one instructor, and needy boys were given the preference. On account of the strong appeal to local boys, applications are not now accepted from other towns. The main school building adjoins the office of the Ford Motor Co., at Highland Park, and preparations are under way for a second school on a larger scale at the Fordson plant.

The boys entered in the trade school are paid at the rate of $7.20 a week throughout the year, including a vacation period of 3 weeks in the summer and one week at Christmas. A boy is docked for any time lost wilfully, but in certain instances boys have been kept on the payroll and their hospital expenses paid by the company in cases of sickness.

Instruction is divided into academic and shop work. Shop work takes up two-thirds of the time, and class work one-third. At the close of each six-weeks' period a report is submitted covering the work of each boy. If the marks are good the boy is given an increase of 40c. per week. A boy who applies himself diligently should be earning $16 a week at the close of his third year. To familiarize the boy with banking customs he is given an additional $2 each month, which must be deposited in some savings bank. A free hot lunch is also served each boy every day in the trade school.

Every job in the trade school is done on a work order, and the time is estimated by an expert. No work is done merely for practice, and the older boys carry on actual development work for the company. The income to the company from work done in the school is sufficient to pay all wages of students, salaries of instructors, and upkeep of equipment. — *Iron Trade Review*, April 14.

## Roller Bearings on Rolling Mills

Tests have been performed in the steelworks of SKF in Sweden on steel rolling mills equipped with self-aligning roller bearings made by this company. The bearings were all special sizes as the loads are high and the space in which they can go, small, since the outside diameter cannot exceed that of the roll and the neck must be kept large.

Two roller bearings were placed side by side in each housing to carry the radial load, which was applied through a rounded knife-edge to assure equalization of the load. Thrust amounted to about 15 per cent of the radial load and was carried on a separate roller bearing. In a 9-in. wire mill, the maximum bearing load was about 11,000 lb., while in a 17-in. roughing mill it was about 80,000 lb., not including the flywheel.

Due to the absence of the plain-bearing brake effect, the coupling shocks were transmitted to the work and produced ripple marks. To overcome this trouble, special couplings of universal-joint form with adjustments for wear had to be employed.

The roughing mill was driven by a 220-hp. motor, operating at 100 r.p.m., and running light it consumed 30 kw. with plain bearings and 13.5 kw. with roller bearings. The difference represents a power saving of 55 per cent. Other mills showed savings as high as 65 per cent. If smaller motors had been substituted greater economies would no doubt have been shown. Aside from the saving in power, it is claimed that rolls so equipped maintain their setting over long periods since there is practically no wear when the enclosures are correctly designed.

Hot-reeling mills have also been equipped with roller bearings.—*Engineering, April* 15, 1927.

American Machinist

*Editors:* KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

## *Banishing Secrecy as to Shop Costs*

SECRECY as to the cost of tools, materials and shop work in general, seems to be going by the board. Some shop managers feel that the more the men and the foremen, particularly the latter, know about cost, the more care they will take to prevent losses. So, instead of costs being a dark secret, as formerly, we now find shops in which each department gets a weekly report of the losses due to spoiled work, to tool breakage, to machines being idle and to absences from the shop.

When the actual dollar cost of spoilage, not only in labor but in material and overhead, is brought home to the department, it means much more than any statement as to spoiled work being two, three or five per cent. It also gives a man added respect for a reamer, grinding wheel or other tool to know that it costs from $25 to $100 or more.

A man does not realize that a day's absence from the shop means more than the loss of pay and, as he suffers this himself, he may feel that the firm has no interest in it. The loss, both in production and in idle time of his machine, is usually much more than he has ever dreamed possible. Loss, due to accidental injury, is somewhat similar.

Another phase of this policy is the education it affords to foremen along the line that makes them better fitted for higher positions. A foreman who knows costs, as well as how to plan work and handle men, is good material for advancement into more responsible positions.

## *Manganese and the Tariff*

PRODUCERS and consumers of manganese are still engaged in a war of words on the subject of protection for the local industry, with no direct line-up on either side. Ferromanganese has now become a vital material in industry because of the increasing uses of alloy steels, and because of the great value of manganese in small quantities in all steel manufacture, so that any question of a tariff that will affect production or prices is of importance to all builders of machinery.

In general the producers have been seeking a higher protective tariff, but a new element has been injected into the situation by the reports on the meager supply of domestic ores as made by the Bureau of Mines, and by the comparison of costs as submitted by local producers. One of the war-time makers of ferromanganese declares that by the electric furnace method the alloy can be produced effectively from ores with as low as 30 per cent manganese and with as high as 30 per cent silicon, but that in peace time it is not economical to operate these furnaces with the low-grade ores.

The War Department and certain of the officials of the Bureau of Mines have advanced the opinion that the supplies of domestic low-grade ores should be left in the ground for emergencies, and the cheaper high-grade foreign ores should be imported. On the surface this proposal sounds reasonable, provided, of course, that enough of the domestic industry is kept alive to provide for rapid development when the emergency does arise. However, now that all sides are at work on the matter, it is to be hoped that a plan of action will be worked out that has a sound economic basis.

## *Local Taxation*

FEDERAL taxes are considerably less onerous than they have been although there is still much to be done to equalize the distribution of the remaining burden, which bears disproportionately on business and industry. Local taxes, on the contrary, are headed in the other direction and at breathless speed. The municipal and state governments are in need of some of the "business in government" that has been applied so successfully in Washington.

It is apparently futile to expect any improvement in taxation methods from politicians or lawyers and it is therefore up to the business man to wade in and take a part in solving the problem. Otherwise it never will be solved and business and industry will pay a large proportion of the bills.

## *Grinding—Honing—or Lapping*

IF ANY one doubts the need of standard terms in machine shop work, the confusion everywhere apparent in regard to grinding, honing and lapping should provide food for thought. Neither makers nor users agree as to the proper use of the terms. One well-known maker, for example, calls his device a grinding head, while most of its users refer to it as a hone.

All three operations remove metal by the use of an abrasive. The difference is in the method of applying it. As with so many other differences of opinion it isn't so important to know who is right as it is to agree upon terms that will mean the same to all those interested.

# Shop Equipment News

## Comtor Measuring and Inspecting Instruments

AN INTERCHANGEABLE system of diameter control has been perfected by the Comtor Co., Box 215, Waltham, Mass., for use in speeding up production measuring and checking. To this end a line of measuring instruments has been developed. They are shown in the accompanying illustrations. The system includes not only the measuring instruments, but also means for producing the working reference standards, and flexible-unit means for storing, identifying, charging out, and checking shortage of the ring, disk and gage-block standards, at the same time caring for the continuous growth of the equipment in new and duplicate sizes.

All instruments of the Comtor System are of the automatic spring-operated type, in which the gaging or contact surfaces are applied to the reference standard and to the work in progress by a uniform spring pressure so as to eliminate the human factor in measuring. This spring operation is said to cause precise and automatic squaring of the anvils on the work. All flat anvils and other contact surfaces are of precision gage-block manufacture and are made of special tool steel, hardened, tempered, seasoned, lapped, and light-wave tested.

In Fig. 1 is shown the Comtorgage, Type 0, for use in measuring outside diameters. In grinding operations it may be held on the revolving work, while the grinding is in process. The anvils are reversible and invertable into four new wearing positions. The center stop is automatically adjusted by the setting of the upper arm.

A Comtorgage with special anvils for measuring the diameter at a fixed point on a taper is shown in Fig. 2. This instrument is also well adapted to measuring the depth of screw threads by the three-wire method. The wires are easily slipped into place and are automatically held. The pitch diameter of the thread can be read directly on the dial, without computation, through the use of a special cylindrical reference standard and "best wires." The Type 1 Comtorgage for measuring holes over 2 in. in diameter is similar to that shown in Fig. 1 except in the arms and anvils and in the omission of the center stop. Also the spring is reversed.

For measuring holes under 2 in. in diameter, the Comtorplug shown in Fig. 3 is used. The instrument is contracted by hand and released in the hole, where it is expanded by its spring. Different sizes of interchangeable expansion plugs fit the amplifier casing.

In Fig. 4 the Comtorslide is shown. The jaws are adjustable onto gage blocks, cylindrical standards, or rod gages and the inside type of Comtor instrument is then set between the jaws. The hard steel precision anvils can be turned to four new wearing positions. The use of the Comtorslide is said to eliminate the need of special and large reference ring gages. The instrument is of all-steel construction and is hardened throughout. It is light and portable and can be mounted vertically or at any angle.

For use with the Comtorslide, small and comparatively cheap sets of precision gage blocks, known as Comtorblocks, Fig. 5, are supplied in basic sizes in steps of sixteenths. For occasional special holes, the usual decimal set of precision gage

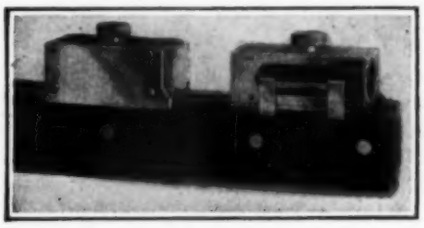


*Fig. 4—Comtorslide*

blocks can be employed. Fig. 6 shows the Comtorbox for holding these gages. The flexible unit construction consists of pairs of easily removable and interchangeable rails in which the suspended bottom support is adjustable for elevating any diameter of standard to its convenient level. The complete unit with its load may be lifted out and transferred. The identification clips are moved and clamped where required and the identification plate slipped into place under the window.

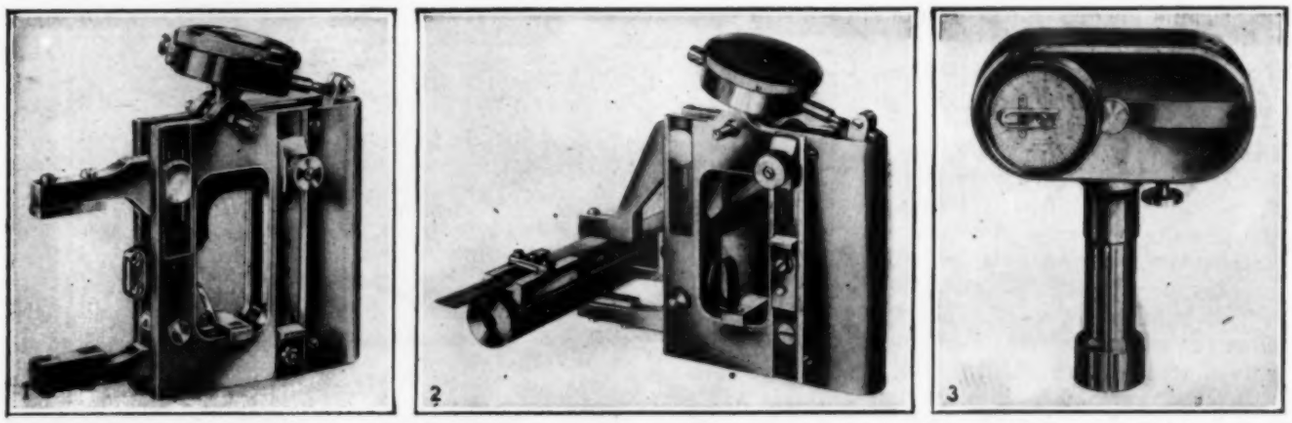



*Fig. 1—Type 0 Comtorgage for outside diameters. Fig. 2—Comtorgage with special anvils for measuring tapers Fig. 3—Comtorplug*

# Shop Equipment News

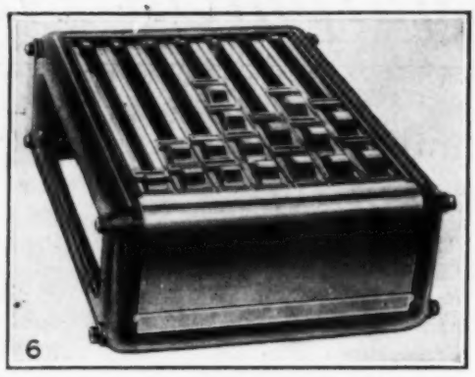


*Fig. 5—Comtorblocks mounted on Comtorstand. Fig. 6—Comtorbox*

The reference standards are arranged in the order of their increasing diameters. It is intended that the workmen's checks be deposited in the box for the standards issued, so that if a space is not filled or accounted for a loss is indicated.

In Fig. 5 is shown the Comtorstand which is a convenient device for supporting the cylindrical working reference standards at the place where the measurement is to be made. In this way the piece assumes the temperature of the room and is not distorted or expanded by bodily heat due to handling.

The Microcomtor is another unit in the series of high-precision type for producing working cylindrical standards. It was described on page 856, Vol. 60, of the *American Machinist* under the name "Microgage." It has been found by trial to be dependable to plus or minus 30 miliionths of an inch.

## "Wolf" Portable Link-Type Sawing Machine

The "Wolf" portable link-type sawing machine illustrated has been designed by the Reed-Prentice Corporation, Worcester, Mass., for use in construction work and various sawing operations about the plant. The machine shown is driven by a single motor capable of developing 2 hp. intermittently. It has a capacity for cutting work 25 in. in diam. at the rate of 2 sq.ft. per min. in soft wood, with a corresponding reduction in hard wood. The machine can also be furnished with two motors of the same rating with a capacity of work 30 in. in diam. and a cutting speed of 3½ sq.ft. per min. in soft wood, or with a single motor developing 3½ hp., intermittently, having a capacity of work 24 in. in diam. and a cutting speed of 3 sq.ft. per min. in soft wood.

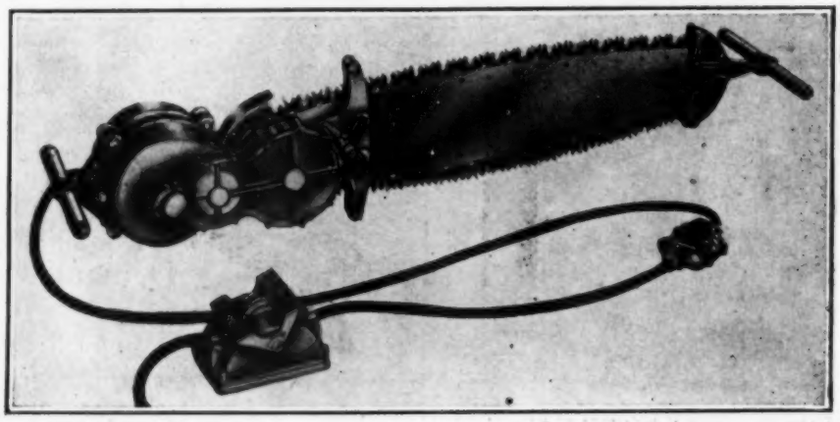
The machine is regularly supplied with motors operating on 220-volt, 60-cycle, 3-phase alternating current or from a portable motor-driven generator set, which this company is prepared to supply. The motor is of the induction type and is inclosed in a two-part, dust-proof housing cast from an aluminum copper composition. The motor pinion, sprockets, shafts and drive gears are all alloy-steel forgings machined to close tolerances. All journals are supplied with double-row ball bearings. The intermediate gear is made of bakelite-micarta to insure quiet operation.

The frame is made of four pieces of selected saw steel, heat-treated and rigidly assembled by electric welding. The filler piece, which is smaller than the outside plates, forms a channel around the edge of the frame that the saw links travel in, assuring straight cutting. Four steel guide pins, a shaft and two spiders (one on each side of the machine) connect the saw frame to the drive end. The four guide pins hold the frame in positive alignment and the shaft and spiders clamp it rigidly to the motive end.

The saw links are made of individual pieces consisting of raker and cutter links, link pins, and bushings. The cutters are held firmly in alignment by the pins and bushings and the latter act as spacers as well as pivots on which the raker links turn. These are made of high-grade steel, heat-treated to give the necessary hardness and resiliency. The action of the saw links is the same as that of a rigid saw and all possibility of buckling is said to be eliminated as the raker and cutter teeth act in opposition to each other. The links on the cutting side of the machine travel towards the motor, thus always keeping the machine against the work and eliminating dogging or fastening.

Two handles are furnished, one at each end of the machine in a convenient position for either horizontal or vertical cutting. The outer handle can be removed to withdraw the machine from the cut in case of wedging. The machine is started and stopped by a foot switch which is housed in a casting of aluminum-copper composition. A three-point reversible plug of special design permits reversing the motor and hence the cutting direction of the saw teeth.

The ball bearings in all journals are lubricated by a light grease while a positive lubricating system in the frame keeps the saw links oiled. The center of filler space is cut away, thus creating an oil reservoir from which the oil is carried by felt wicks to the bottom of channel in the saw frame and thence by centrifugal force to the link joints.



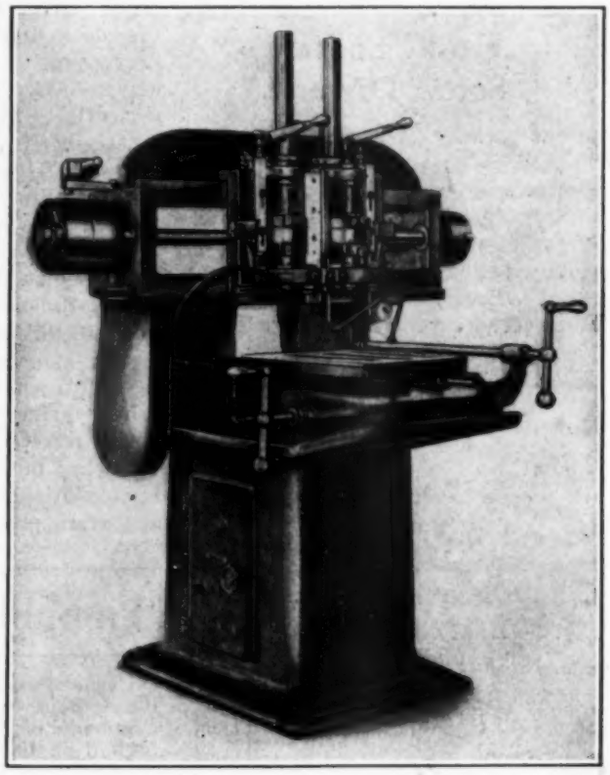
*"Wolf" Portable Link-Type Sawing Machine with single motor*

# Shop Equipment News

Nine feet of heavy rubber-covered flexible conduit is regularly supplied with the machine. The top section of the saw teeth is provided with a protective guard and the saw teeth have an ample factor of safety so that the motor will not break the links. In addition, to counteract undue stress occasioned by sudden shock, a safety pin is provided.

## Frew No. 5 Profiler

THE two-spindle No. 5 profiler shown in the photograph is being marketed by the Frew Machine Co., 124 West Venango St., Philadelphia, Pa. It can also be furnished in single-spindle and multiple-spindle types. As shown, the machine is driven by a single tight-and-loose pulley mounted, at one end of the upright, on a back shaft terminating in a change-gear box. The machine can also be arranged for motor drive, in which case the motor is mounted on the upright and is geared to the back shaft in place of the tight-and-loose pulley. A 3-hp. motor operating at 1,200 r.p.m. is required. Four gear changes are provided, and with the driving pulley running at its normal speed of 500 r.p.m., spindle speeds ranging from 452 to 863 r.p.m. can be obtained. The main driving shaft carries two steel spiral gears, hardened and ground, which mesh with spiral gears on the spindles. The spindles themselves are made of special steel and run in bronze boxes, conical in shape on the outside so that they can be adjusted for wear. High-grade ball thrust bearings take the thrust from the spiral gears. The standard taper in the spindle is No. 7 B&S, but special tapers can be provided if necessary. Micrometer adjustment is provided for the vertical motion of the spindle, and the cross motion is controlled by means of a ball crank.

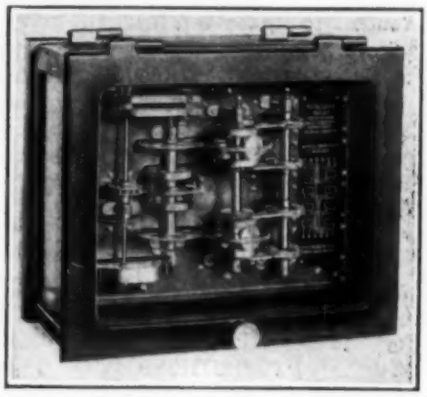


*Frew Two-Spindle No. 5 Profiler*

The movement of the table is also controlled by means of a crank, which can be located on either the right- or the left-hand side of the bed, as desired. The working surface of the table is 12x15¼ in. and the distance between uprights is 16 in. The table has a longitudinal movement of 20 in., while the movement of the cross-slide is also 20 in. The vertical movement of the spindle is 3 in. The distance from the table to the bottom of the cross slide is 5½ in., but it can be increased.

## General Electric Type DT Totalizing Demand Relay

A device for totalizing the simultaneous demands of several individual circuits has been developed by the General Electric Co., Schenectady, N. Y. The type DT relay



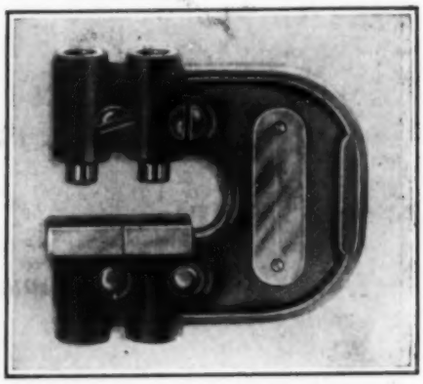
*General Electric Type DT Totalizing Demand Relay*

shown in the illustration totalizes the demand from several watt-hour meters and allows the summation to be transmitted to one demand meter, which can be of any contact-operated type. The relay can be furnished in forms suitable for totalizing the demand of any number of circuits from two to eight. In size, as in appearance of the case, it is similar to the type PD demand meter.

## Greenfield No. 1616 "Rapid-Inspection" Limit Snap Gages

The Greenfield Tap & Die Corporation, Greenfield, Mass., has added to its line the No. 1616 "Rapid-Inspection" limit snap gage shown in the illustration. Ten different frame sizes are provided for the handling of the work from 0 to 6 in. in diameter.

The particular feature of this gage is the solid jaw extending beyond the frame of the gage. Upon this projecting surface it is con-



*Greenfield No. 1616 "Rapid-Inspection" Limit Snap Gage*

# Shop Equipment News

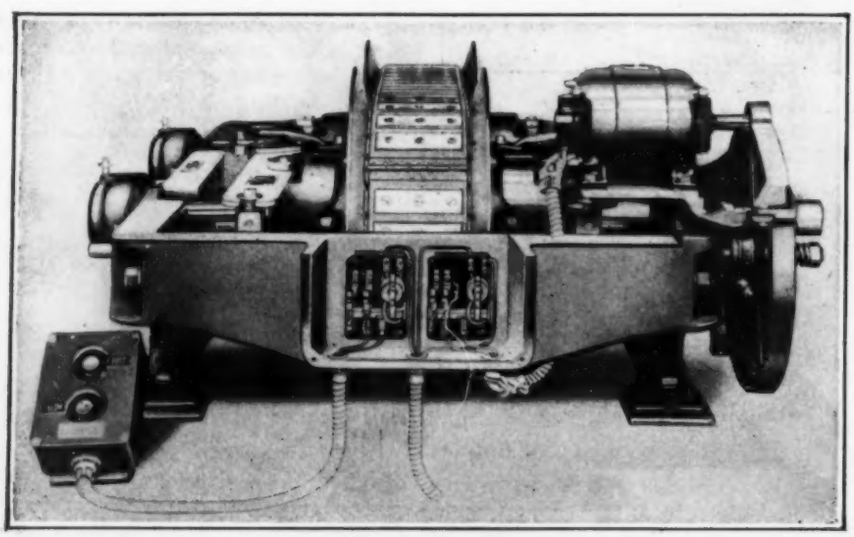
venient to locate and level the work before moving it toward the actual measuring anvils. It is said that the method of adjusting and locking the anvils has been greatly improved and simplified. Each anvil may be adjusted and locked without disturbing any of the others.

## Reeves Remote-Control Variable-Speed Transmission

The Reeves Pulley Co., Columbus, Ind., has recently added an electrical remote control to its standard variable-speed transmission. The control consists of a fractional-horsepower, reversible motor mounted on a bracket above the shifting screw of the transmission and connected to the screw by a single reduction of spur gears. This motor is started in either direction by one or more push-button stations operating through a magnetic switch of special design. Because of the small power consumed, it is possible to connect the actuating motor to a standard lighting circuit. For protection in case the operator should hold the push button beyond the slow or fast limits of speed, a patented safety clutch prevents jamming of the motor or transmission.

The auxiliary magnetic switch is placed in a receptacle cast in the frame end of the transmission. It is of latest design and is universal as to current characteristics. It is completely self-contained, and no transformer is necessary. The motor runs only when one of the buttons is depressed, so that the amount of speed variation is a direct function of the duration of contact. Hence the speed can be controlled within small limits.

This electrical remote control is said to be of particular value in connection with machines of considerable length, such as corrugating machines, traveling bread ovens, material handling conveyors, bread proofers, etc., where it is inconvenient for the operator to leave the machine to adjust the speed transmission by hand.



*Reeves Remote-Control, Variable-Speed Transmission*

## Husky Socket Screw Drivers

The Husky Wrench Co., Milwaukee, Wis., has brought out a complete line of socket screw driver units. This line includes four sizes of extra-short screw driver bits, three sizes of interchangeable socket screw drivers, and four lengths of all-metal screw driver handles. These pieces are to be seen in Fig. 1. All

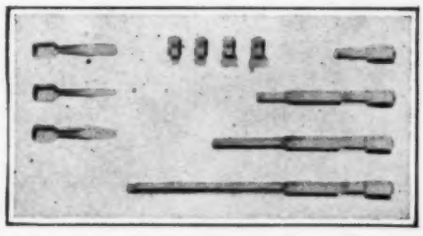


*Fig. 1—Husky Socket Screw Drivers and Handles*

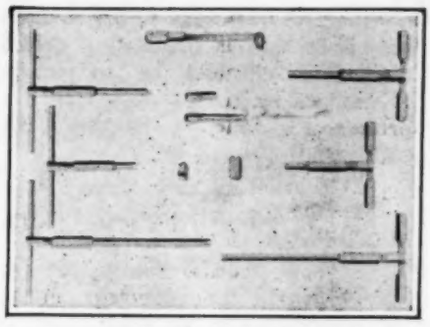


*Fig. 2—Husky Socket Handles*

units are designed for heavy work and can be used with standard Husky wrench handles. Swivel grips on the screw driver handles serve to hold the screw drivers at any angle, thus preventing the slipping of screw driver bits. The bits are shaped correctly to fit slots of wood screws, fillister-head and all other slotted screws. They are hand-forged of toughest alloy steel, properly heat-treated and nickel plated.

Other units made by this company, shown in Fig. 2, include three sizes of combination "Speed" tees with 10-in. sliding handle bars and swivel grips; three sizes of Speed tees with solid hexagon handles and swivel grips; an improved Husky tilting offset handle; a special socket for wing nuts, alemite fittings, and twenty-five additional sizes of sockets and drain plug adaptors.

## Pamphlets Received

**Export Business.**—The Foreign Commerce Department of the Chamber of Commerce of the United States, Washington, D. C., recently issued a pamphlet entitled "Doing Export Business?" This publication contains sixty-four 6x9-in. pages bound in attractive paper covers. It presents general condensed information useful to the manufacturer who is considering the marketing of his product in foreign fields. The subject is divided under five heads: Surveying the Field, Establishing the Export Department, Promoting Foreign Sales, Filling Export Orders, and Miscellaneous Considerations. The treatment is quite comprehensive and the paragraphs have indented captions for ready reference. The pamphlet may be obtained from the publishers for 15 cents.

**Illumination Terms.** The Edison Lamp Works of the General Electric Co., Harrison, N. J., has published Bulletin LD 155, being a complete dictionary of illumination terms. The pamphlet contains fifty-six 6x9-in. pages.

# NEWS OF THE WEEK

## Increased Production Is Remedy for World's Economic Ills

*Special Cable to American Machinist*

The initial discussion of the International Economic Conference at Geneva brought out a general agreement among representatives of the forty-seven countries represented, that increased production is the remedy for the world's economic ills. This information is contained in a special dispatch from Edward J. Mehren, vice-president of the McGraw-Hill Publishing Co., Inc., who is attending the conference.

Increased production would increase purchasing and consuming power and automatically raise the standards of living. There was general solicitude for the well-being of workers. W. T. Layton, editor of the *Economist*, contended that the world could not return to pre-war conditions. He said that a new equilibrium must be established, due to the increase in industrialization, to the fact that the United States is a creditor nation, to the decrease of European emigration, and to the alteration of trade relations resulting from the payment of reparations and international war debts.

Henry M. Robinson, chairman of the American delegation, sketched the development of our prosperous industrial situation, stressing the determination of American employers to secure needed economies by better management and machinery, but not by reduced wages. He affirmed the American belief that competition stimulates industrial progress and suggested that the American delegation would probably disapprove of international cartels if governments participated or if they were exploitive in character.

It is not expected that the conference will have great or important immediate results, but that it will contribute to a better understanding of international problems and will lay a basis for some definite action now and in the future.

## Aircraft Display Shows Development of Industry

The first "All-American Aircraft Display" was held at Bolling Field, Washington, D. C., from May 2 to May 6. It was held under the joint auspices of the Aeronautical Chamber of Commerce and the National Aeronautic Association. C. G. Peterson, of the Wright Aeronautical Corporation, was the manager of the display. It was held at this time at the suggestion of the Department of Commerce in order to afford the aircraft industry an opportunity to demonstrate its products to the delegates of the Third Pan American Commercial Conference, the Pan-American Commercial Aviation Conference and the United States Chamber of Commerce which were in session in Washington at the time.

The exhibits and displays of manufacturers of aircraft equipment and supplies were housed in two large hangars loaned and prepared for the purpose by the U. S. Army Air Corps.

The commercial airplanes on display were undoubtedly the most varied collection of machines gathered together at any one time in this country. Among the commercial machines exhibited were Waco, Fokker, Buhl, Fairchild, Ford, Hamilton, Stinson and Travel Air.

## Machine Tool Builders Celebrate Anniversary

Financial problems and a paper on safeguarding of machine tools vied with the celebration of their twenty-fifth anniversary for the attention of the members of the National Machine Tool Builders' Association at the meeting held at the Hotel Thayer, West Point, N. Y., may 10 to 12, 1927. The first session was devoted to the reports of the president, general manager and treasurer. After the recess for luncheon there was general discussion of these topics: "What is a sound capital structure for an average machine tool plant at today's values?" "What is a fair rate of profit on such a financial structure?"

In the evening the birthday celebration dinner was held, and following it there was a showing of the Norton Co.'s motion picture, "The Age of Speed."

Group meetings and golf occupied Wednesday morning and the afternoon was given over to committee reports and a paper by G. V. Fuller, assistant secretary, National Council on Compensation Insurance of New York. His subject was "The Proper Safeguarding of Machine Tools."

The morning session on Thursday took up topics of general interest to the members, discussion being informal. At noon the convention adjourned and joined forces with the Metropolitan Section of the American Society of Mechanical Engineers and a number of other organizations in witnessing a National Defense Demonstration arranged by the military authorities.

## A.G.M.A. Meeting

The annual meeting of the American Gear Manufacturers Association opened today in the Hayes Hotel, Jackson, Mich., and will continue for three days. Due to the publication of the Fiftieth Anniversary issue of the *American Machinist* on May 19, the report of this meeting will appear May 26.

## Manning, Maxwell & Moore Abandon Machine Lines

An announcement of considerable interest to the machine tool industry was made last week by Manning, Maxwell & Moore, Inc., of New York. This company has acquired the entire line of heavy machine tools formerly manufactured by the Detrick & Harvey Machine Co., of Baltimore, and also the Beaman & Smith line of milling machines and special production machines for automotive and other operations. which line was formerly manufactured at Providence, R. I. They have taken over these lines completely, including good-will, patterns, drawings, etc., and will develop and produce them at the plant of the Putnam Machine Co., Fitchburg, Mass.

This program necessitates devoting the entire selling efforts and general resources to their own lines, and, therefore, they are discontinuing the sale of machine tools for other manufacturers with a few exceptions. The branch offices at Birmingham, Philadelphia, Buffalo, Boston and Cleveland will be closed, but direct representatives will be located in those territories to conduct sales and service of Putnam tools, including the new lines and developments, and products of the Shaw crane plant.

The Chicago office will be continued as a department of Manning, Maxwell & Moore, Inc., under the management of R. S. Dean, and in that territory a selective line of machine tools will be handled in addition to products of the Putnam and Shaw plants.

### Executive Control

Both manufacturing and sales operations of the Putnam and Shaw plants will be under the executive direction of Frank J. Baumis, vice-president of Manning, Maxwell & Moore, Inc., and president of the Putnam Machine Co. Joseph Wainwright will be general sales manager of machinery sales, and W. B. Clarke will be general sales manager of crane sales.

Manning, Maxwell & Moore, Inc., will continue to act as exclusive sales agents in the railroad trade for the Monarch Machine Tool Co. and the Amplex Machinery Co., and will also engage in an extensive program of development covering new and special machinery of various kinds, notably a new form of gearing to be used for automobile differentials and other purposes.

The Ashcroft, Hancock, Consolidated and other steam specialties manufacturing and sales activities of Manning, Maxwell & Moore, Inc., are in no way effected by these changes and will continue as in the past.

# The Business Barometer

## *This week's outlook in Commerce, Finance, Agriculture and Industry*

By THEODORE H. PRICE
*Editor, Commerce and Finance, New York*

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IT IS a strange thing to say, but it now looks as if the Mississippi flood will revive the boom that it at first threatened to submerge.

For an explanation of this paradox we must go back to the World War. When it started in July, 1914, the bottom dropped out of all the security markets, the stock exchanges were closed and every one seemed agreed that the world's wealth and purchasing power would be completely destroyed.

But by March 1915 the buying of the belligerents began to have its effect, the war boom commenced and it continued until well after the armistice, except as it was interrupted by premature rumors or predictions of peace.

So it is with the flood that has overwhelmed the Mississippi Valley. At first it was assumed that it would bring about an acute depression because of the losses caused and the values that had been wiped out.

But as the dimensions of the extraordinary disaster have come to be appreciated and it is evident that the whole country will demand that its repetition shall be prevented there is a feeling that the Government will be compelled to spend at least a billion dollars in flood prevention work and that the expenditure of this great sum will increase the demand for everything, quicken the circulation of money and resuscitate the speculative movement that appeared to be languishing two weeks ago. In how far this theory is warranted remains to be seen, but it is sustained by some precedents, and by its appeal to the imagination the decline in the stock market has been arrested.

Apprehension over the financial situation in Japan has also been dulled by the announcement that the Government would be asked to guarantee any advances that the Bank of Japan would have to make in order to prevent further bank failures when the moratorium expires, and as the Chinese revolution seems to be wearing itself out the situation in the Far East has a less sinister aspect.

May Day has also brought an improvement in the European outlook—especially in the British outlook—and with cheaper money in London, Paris and Berlin, there has come a decided revival of speculative activity in the security markets overseas.

Therefore it is possible, if not probable, that the summer may see a secondary boom in America and that the liquidation which many had expected during May will be deferred until later in the year. The acceptance of this view has led to considerable rebuying of stocks by those who had sold out two weeks ago, and if the Federal Reserve Banks shall reduce the rediscount rate as some predict a further advance may be seen on the Stock Exchange.

But such an advance, if it comes, would not alter the fact that prices are now higher than they have been for years and that no one ever went broke by taking profits, even though he failed to hit the top.

Among the staple commodities cotton is the only one that has shown much activity. Quite naturally it advanced when the news from the Mississippi Valley grew more alarming, but there are still some veterans of the trade who recall that good crops were made in the flood years of 1882, 1912, 1913 and 1922. Meanwhile an increased acreage in Texas is predicted as a result of the advance in price, and the Little Rock *Gazette* reports that replanting has already commenced in Arkansas. The dry goods market has followed the advance in cotton but slowly, and the demand is less active than it was.

Coffee is still unsteady because buyers are awaiting the movement, which will soon be under way, of the largest world crops on record. Meanwhile stocks are running down but further selling pressure is expected before their replenishment begins. Rubber is stable, and as both producers and tire manufacturers are anxious to keep it so no wide fluctuations are looked for. Copper is another of the commodities that are practically stabilized but last week it was dull and easier. The oil flood is still increasing and, as authorities say the period of overproduction may last for some time, no early price recovery is anticipated.

The moderate recession in iron and steel activity that began about a month ago is still unchecked. The operations of the U. S. Steel Corporation are again below 90 per cent of capacity, and existing stocks must be reduced before renewed buying can be expected. The automobile industry is marking time waiting for Ford's new models, and a decline in production is likely unless sales improve. But in building the news is distinctly cheerful.

Considering the situation in its entirety it must be admitted that business has withstood the shock of the Mississippi flood better than might have been expected. The resistance shown is largely due to the belief that the post flood expenditures for reconstruction and prevention will equal or exceed the losses caused by the overflow. This may be true, but it may be well to remember that the Government can spend no money until Congress appropriates it and that unless the President calls a special session no appropriation can be made before next December.

## WHAT'S DOING IN INDUSTRY

**THE INACTIVITY that was reported in machinery and machine tool markets last week continues without change. Sales are slow and are confined mostly to orders for single machines to place worn-out or obsolete equipment. The character of present inquiries, however, leads to the belief that business will improve somewhat before the summer months.**

**CINCINNATI reports a dull season, but prospects are better than heretofore. Lack of buying by railroads and large industrial users is responsible for a temporary lull in Chicago. Sales in Detroit are small, only special tools being in demand; automobile manufacturers are still watching and waiting. A better condition generally is reported in Milwaukee, sales and inquiries showing an increase.**

**BUFFALO is experiencing a slight improvement, both in sales and in inquiries. The New York market reports sales slow but inquiries on a better basis. The machinery industry in New England has not been seriously affected by some of the unfavorable conditions in that territory and manufacturers and selling agents are busy. No noticeable improvement is seen in Philadelphia, but encouraging inquiries are being made by certain branches of the metal trades. Further inactivity is reported from Cleveland.**

**BUSINESS has withstood the shock of the Mississippi flood and other recent adverse happenings better than had been expected, and it is generally believed that stability will prevail throughout the summer.**

# The Industrial Review

## *Weekly progress of the machinery and machine tool business*

**THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:**

### NEW ENGLAND

Although a slight depression in business in general is showing up in the New England territory at this time, the machine-building industry and machinist lines have escaped its influence. Nowhere, so far as could be ascertained, has there been any let-up that warrants any change in operating schedules and no changes in production schedules are contemplated. For the most part the business in hand is on orders, under contracts, some of which assure continuance of steady operations for two or three months at least. In some lines, such as special machinery building, the business booked will carry through to the end of the year at least and there is a substantial volume of prospective business in this line.

There is a touch of pessimism in some of the hardware and metal specialties in some places.

Heavy export shipments went out from Hartford during the past two weeks. A substantial volume of future business for continental and Mediterranean countries is indicated in inquiries received.

### MILWAUKEE

The volume of sales in metal working equipment so far in May gives more color to the general picture of this business, and with inquiry improving steadily, manufacturers as well as dealers find more encouragement than in several months. The automobile industry is doing better than the outlook promised, and the ultra-conservatism that had marked buying from this source is giving way to activity.

General industrial demand for tools continues to be of moderate proportions as a whole, but virtually all sales are in single units. A few sales have been made to railroads, this business being largely for replacements. Builders of heavy machinery are experiencing a relatively good business, but in most cases existing capacity appears to be sufficient to meet all current needs.

Export sales maintain a fair average, Japan and South America being perhaps the best customers.

### CHICAGO

Conditions in the machine tool market continue without change. The volume of trade reported for the last week shows no evidence of an upward trend in the immediate future. As previously indicated, railroads are looked to for the bulk of such business as may be done in the next few weeks, industrial demand having declined to a degree that renders it of comparatively small importance as a whole.

Inquiries, however, continue to be received by the leading dealers in satisfactory number, the drawback being that most of them are indefinite as to early buying, the prices asked for tools constituting the main point of inquiry on the part of prospective customers. The Union Pacific, Santa Fe and Northwestern railroads are expected to close several items on their lists at an early date.

The Chicago, St. Paul Minneapolis & Omaha R.R. is reported to have issued a list within the last week for a number of tools of various types. Among industrials, the International Harvester Co. and the Western Electric Co. are doing some buying, their purchases being limited to single tools and small lots. Dealers are looking forward to the annual list to be sent out by the I. C. R.R., which in former years has been issued shortly after the making up of the annual budget, within a month or two of the year's beginning.

Used tools are in light demand, and in some instances prices are being cut.

### BUFFALO

Business in the machine tool field in Buffalo remains practically unchanged from conditions reported two weeks and even a month ago. The only encouraging factor was reports from a few, but not all, of the dealers that there had been an increase in the number of inquiries in the first part of May. Whether this is merely a flurry or the beginning of a general improvement in this field, it is too early to determine.

Small orders are being placed in fair volume but buying continues to be on a hand-to-mouth basis.

What has been said for the general machine tool business, also may be said for the electrical equipment trade. Perhaps the volume is a little higher in this branch of the business, but the buying here is on a small order basis. One firm reported that it had orders from more different sources last month than at any time in its history. The demand for contractors' equipment is seasonably good.

### PHILADELPHIA

Although business conditions in machinery and machine tool lines in the Philadelphia market have not improved as rapidly as had been expected a month ago, there are no signs of discouragement.

Inquiries from Southwestern roads were more numerous and held out more hope for the development of orders than Eastern roads, as the needs of the South seem to be greater than in the East or Central West.

There have been a few purchases from the automotive industry from producers of bearing machinery, but the business from that source is still uncertain. There have been some inquiries from the metal trades to producers of forging hammers and slotters, but no substantial closing of orders. Producers dealing with wood-working machinery concerns report business below what it was a year ago.

### DETROIT

The machinery market in Detroit has experienced a slump in the past two weeks. While the prospects for future business still seem as bright as they did a few weeks ago, the present crop of orders is small. This is largely due to the fact that the March total of automobile sales was lower than the expectations. It is also due, in a measure to the fact that most of the manufacturers are awaiting certain rumored development in the automobile field that may have a tendency to alter the situation throughout the industry.

Inquiries for standard machinery and machine tools are coming in slowly. There is some demand for special equipment and a few good sized orders have been placed within the past week. This field seems to be far ahead of the general average for the entire machinery business here.

The Hudson plant is contemplating the purchase of equipment for the new Essex. The new Erskine car is exceeding expectations and it seems likely that much new machinery will be required soon.

### CINCINNATI

Machine tool manufacturers of the Cincinnati district report the past week's market dull. A few concerns report a slight gain over the previous week, however. Selling agents did a little better than in the previous week. Both branches of the trade look forward to a better market during the remainder of the month.

The greater portion of the orders booked during the week called for single tools and replacements, the principal purchasers being general machinists and industrial users. The orders were well diversified, calling for all sizes and types of tools. It is stated that the Virginian Ry. placed a small order, purchasing several single tools for replacement purposes. Other railroads made a few purchases from lists on hand. Concerns in the automotive industry did some scattered buying of single tools and replacements.

### NEW YORK

Only one encouraging feature appears in the present trend of the machinery and machine tool market in this territory now. That is the improvement in the number and quality of inquiries being received by dealers and manufacturers' agents. Sales are slow and mostly for single tools for special work.

General industrial users are still the best customers in this district, but they are not buying in quantity and only scattered orders are reported. Automotive interests and railroads are running behind the expected volume of purchases, but better business from this source is predicted before the end of this month.

Buyers of machinery in the past week included: The Eureka Vacuum Co., Ford Motor Co., Western Cartridge Co., General Electric Co., Bell Telephone, Detroit Lubricator, Westfield Trades School, the Chicago, Rock Island & Pacific R.R., and two of the large steel producers.

### CLEVELAND

Inactivity marks the condition of the local machinery and machine tool market for the past fortnight. Further declines of sales is having a discouraging effect on the local industry. April failed to show a gain over March in sales volume.

Orders coming into the local market are for single units from diversified lines. Salesmen are concentrating more effort on the smaller shops which they find are busier than the larger industries. Industrial employment in Cleveland is on the upgrade. A recent survey by the Chamber of Commerce shows a 10 per cent increase for April over March.

# Less Need for Government Regulation of Private Business, Says O'Leary

## *U. S. Chamber of Commerce meeting at Washington*

BY SELF regulation, American business is bringing about a condition which will result in fewer restrictions being imposed upon private enterprise and initiative through government regulation. This was the keynote in the address of John W. O'Leary, made at the opening session of the annual meeting of the Chamber of Commerce of the United States, which was held in Washington, May 2, 3 and 4.

Labor and capital have entered upon a new era, in the opinion of speakers at the manufacturing session. America's ideal now is the application of the Golden Rule to labor relations. A striking feature of this session was the fact that no less than twelve of the speakers who took part in the discussion emphasized the far-reaching benefits which have followed the enactment of prohibition legislation. No single word was advanced in opposition to the law and no suggestion for its modification was forthcoming.

### Justice in Industrial Relations

The evils of any system of government doles or pensions were pointed out. Workers should be paid generously, it was held, and then would be in position to provide their own insurance against old age or unemployment. An essential to the placing of industrial relations on a basis of justice, it was contended, is the payment of wages in proportion to the production of individual wage earners.

The point that money is not enough to compensate the workers fully was made with great effectiveness by Arthur T. Morey, general manager of the Commonwealth Steel Co., of St. Louis. He declared the safety movement was the opening wedge for the better industrial relations which exist today.

H. H. Rice, assistant to the president of the General Motors Co., declared that high wages are more a result of prosperity than prosperity is the result of high wages. Prosperity, he asserted, is a result of high average production per man.

City building so as to relieve both street congestion and transportation demands, was the feature of the civic development session May 3. John Ihlder, manager of the civic development department of the Chamber of Commerce, made the statement that the success of the American people can be measured only in the ability of their business men to plan effectively for the future.

No disturbing problems of major character cloud the business outlook in the long perspective, in the opinion of several who spoke at the sessions on May 4. Silas Strawn, chairman of the board of Montgomery Ward & Co., characterized the agricultural situation as one of unusual gravity, but described the prosperity prevailing in industrial centers to be unprecedented. In his opinion the situation as a whole is favorable. Pessimism is disappearing in New England, John S. Lawrence, president of the New England Council, declared in the course of his remarks. Some of the removals threatened two years ago have taken place, he stated, but the losses have not been as great as were predicted and they have been more than offset by gains in other lines.

At the domestic distribution session, it was revealed that the Department of Commerce will take a census of distribution in eleven cities. This census is to follow the lines of that recently taken in Baltimore. The gathering of distribution figures, it was explained, is an experiment. If final results are as valuable as now seems, a national survey will be undertaken.

Now that the fear of the Sherman act has been removed from fact-finding, Judge Edwin B. Parker predicted that there would be little place for government regulation, as business now could regulate itself. While business may not act in concrete to fix prices, or to limit competition unreasonably, or restrict production, Judge Parker declared that it is lawful to assemble facts and distribute them stripped of opinion. In fact, they are essential to the elimination of waste program, he declared.

### Elimination of Waste

At the domestic distribution session announcement was made of the plan to form a joint trade relations committee to seek out manufacturing practices which are wasteful. The Federal Trade Commission, Judge Parker said, has recognized the legality of gathering facts for the elimination of waste. The Commission, he pointed out, is ready to pass upon rules of conduct formulated by industry and will help industry in protecting itself against those who indulge in improper practices.

What is good for the community is good for the railroads. What is not good for the community is not good for business. This statement was made by George D. Ogden, traffic manager of the Pennsylvania R.R., in the course of the discussion of new trends in transportation. The same philosophy, Mr. Ogden said, applies to the motor vehicle and to the use of the waterways. A. J. Brosseau, president of Mack Trucks, Inc., held that the sphere of the railroad is the long haul. Trucks, he declared, are being confined more and more to the short haul.

Government operation of ships was attacked by Philip H. Gadsden, of the United Gas Improvement Co., of Philadelphia. He stated that he is against ship subsidy, but expressed the opinion that private business will find a way to support an American merchant marine. Chairman O'Connor of the Shipping Board, in reply, stated that the board favors a privately-owned merchant marine if that be possible, but it is first for a merchant marine. Another speaker took the position that there is nothing to indicate that the diesel engine is the solution for ship propulsion. He pointed to the progress being made in the use of pulverized fuel and of superheated steam.

Reduction of the corporation income tax and the repeal of the Federal estate tax and of the remaining war excise taxes were asked in a resolution adopted at the close of the meeting. In another resolution attention is called to the fact that increases in state and local taxation have more than offset reductions in federal taxation. The action of Congress in setting up a joint committee to investigate the administrative features of the Internal Revenue system, was commended.

Elimination of wasteful business practices and trade abuses was urged and the formation in each trade of a joint trade relations committee, to cooperate with the Federal Trade Commission, was recommended. Uniform traffic laws were urged and commercial organizations were asked to use unceasing vigor in the prevention of accidents and the tremendous annual losses, due to inadequate traffic facilities.

### Big Future Ahead

A profound impression was made by the views of Henry D. Sharpe, of Providence, R. I., in his contribution in the symposium on "What Is Ahead for Business." "We are living in a fast moving world," he said. "In these days of rapid communication, rapid transportation, portable power and labor saving machines, the pioneering processes are speeded up infinitely over the slow, plodding experiences of our pioneering days. If only education and the creative imagination of men in the great undeveloped countries can be speeded up, we shall see development in the near future on a scale and at a rate that will surpass anything in the past. Foreign commerce means more to us today than ever before and offers a future prospect that challenges the imagination."

Election of officers at the concluding session resulted in the selection of Lewis E. Pierson, New York banker, as president. Edwin B. Parker, of Houston, Texas, chairman of the German-American Mixed Claims Commission, was elected to the newly created office of chairman of the board of directors. Sectional vice-presidents elected were: *East*, A. J. Brosseau, of New York; *South*, Robert R. Ellis, of Memphis, Tenn.; *North-Central*, William Butterworth, of Moline, Ill.; *West*, Paul Shoup, vice-president of the Southern-Pacific Railroad.

Vacancies on the board of directors were filled by the election of the following: Stanley H. Bullard, vice-president of the Bullard Machine Tool Works; P. H. Gadsden, United Gas Improvement Co.; William Chaidler, William Papff, J. G. Leigh; Robert P. Lamont, president, the American Steel Foundries; E. T. Meredith, the Meredith Publications; Dwight B. Heard, Everett C. Griggs, Charles W. Lonsdale, Edward W. Peck, John G. Lonsdale, Walter M. Daniel, H. A. Smith; A. J. Brosseau, president, Mack Trucks, Inc.; Matthew S. Sloan, president, the Brooklyn Edison Co.; and A. L. Humphrey, president, the Westinghouse Air Brake Co.

# Personals

CHARLES L. ALLEN, president of the Norton Co., of Worcester, Mass., is in Europe.

W. D. CREIDER has been appointed general sales manager for the Oilgear Co., of Milwaukee.

W. LACOSTE NEILSON, vice-president and general sales manager for the Norton Co., has returned from Europe.

E. M. SQUAREY has resigned as president of the U. S. Tool Co., Inc., of Ampere, N. J. He has been succeeded by A. E. Borton.

ERNEST C. MORSE has been appointed executive manager of the "Section of New Uses" of the Cotton-Textile Institute, Inc., of New York.

GEORGE MCINTYRE, formerly of the New York City sales force of the Niles-Bement-Pond Co., has been transferred to the Detroit office of that company.

LOUIS B. SEIDMAN announces that he is now engaged in the special practice of engineering law with offices at 1440 Broadway, New York City.

STANLEY H. BULLARD, vice-president of the Bullard Machine Tool Co., of Bridgeport, Conn., has been re-elected a director of the United States Chamber of Commerce.

JACK REDFERN has joined the sales force of the Climax Engineering Co., of Clinton, Iowa. He was formerly sales manager for the Power Manufacturing Co.

A. L. HUMPHREYS, president of the Westinghouse Air Brake Co., of Pittsburgh, has been elected a director of the U. S. Chamber of Commerce.

ARTHUR WHITCRAFT has been appointed Eastern sales manager for the Kensington Steel Co., of Chicago. His headquarters will be at Port Ewen, N. Y.

ROBERT P. LAMONT, president of the American Steel Foundries, of Chicago, has been elected a director of the U. S. Chamber of Commerce.

J. P. ALEXANDER has been appointed Boston manager in charge of all sales and service in the New England territory for the Westinghouse Electric and Manufacturing Co.

R. S. BRAINERD, for many years sales engineer in the New York office of the Niles-Bement-Pond Co., is now covering the New York territory, with headquarters in the New York office at 111 Broadway.

WILLIAM G. ELLIS has been appointed district sales manager in Philadelphia for the Ohio Electric and Controller Co., of Cleveland. He will have headquarters in the Atlantic Bldg.

STEWART M. BUNTING, formerly of the Niles-Bement-Pond Co., and more recently with the Smith, Booth, Usher Co., at Los Angeles, has returned to New York, having resigned his position on the coast.

WILLIAM P. MCCRACKEN, JR., Assistant Secretary of Commerce for Aeronautics, has been appointed by the President to represent the United States on the Inter-American Commission on Commercial Aviation.

WILLIAM H. GAULKE has been appointed chief engineer and general manager of a new steel products division being created and equipped by the Cream City Boiler Co., Milwaukee. Automotive and industrial sheet metal parts will be manufactured.

W. O. FORMAN has been appointed works manager of the Putnam Machine Works, of Fitchburg, Mass., succeeding Augustus Wood, who has become consulting engineer for the Putnam Machine Works and for the Shaw Crane Works.

H. O. LOWN, of Texarkana, Tex., has purchased the plant, equipment and other properties of the San Angelo Foundry and Machine Co., of San Angelo, Tex., and following the installation of additional machinery and equipment the foundry and shops will continue operation.

ROBERT CRAMER, mechanical engineer and consultant, of Milwaukee, has been appointed chief engineer of the Milwaukee Metropolitan Sewerage Commission. Mr. Cramer has been a member of the commission since June, 1923. He has been in private practice of engineering in Milwaukee for many years, specializing in power plant, sanitary and industrial building.

# Business Items

John H. Glover, representative in Chicago for several machinery manufacturers, announces the removal of his offices from 2120 N. Menard St., to 2127 N. Sayre Ave.

The Buffalo Forge and Steam Pump Co., of Buffalo, N. Y., announces the opening of a new Southeastern branch at 720 Brown-Marx Bldg., Birmingham, Ala., for the distribution of heating, ventilating, drying and pumping equipment and parts. P. T. Elliot is in charge as district manager.

The Simmons Machine Tool Corporation, of Albany, N. Y., announces the appointment of the following sales representatives: Roy M. Alexander will cover part of New York and New England. A. J. Weisbecker will cover New York City and will be manager of that office. Mr. Weisbecker was for many years associated with the Vandyck-Churchill Co.

The Arch Machinery Co., Inc., has been organized in Pittsburgh to act as sales representative in that territory for the Putnam Machine Co., and for the Shaw Crane Works. Other lines will be added in the future. This new company is made up of former members of the Pittsburgh office of Manning, Maxwell & Moore, Inc. These members include Norman Allderdice, Thomas Rees, Harry Cross and John Hussey.

The Brandes-Merrick Machinery Co. has been organized with offices in the Keith Bldg., Cleveland, Ohio. The firm consists of F. A. Brandes, former owner of the Brandes Machinery Co., of Cleveland, and E. H. Merrick, who had been district manager in Cincinnati and Cleveland for Manning, Maxwell & Moore, Inc. The new company will conduct a general machine tool business, and will also handle cranes, hoists and welding equipment.

Announcement is made of the purchase by the Simonds Saw and Steel Co., of Fitchburg, Mass., of the plants and business of the Abrasive Co., of Philadelphia. The Abrasive Co. manufactures "Borolon" wheels for grinding steel and metals of high tensile strength, and also "Electrolon" wheels for grinding cast iron, brass, bronze, and metals of low tensile strength. The Abrasive Co. has a complete organization of branches and sales outlets and will continue to sell through the same channels as in the past.

# Obituaries

CLARENCE K. PRINCE, general superintendent of the H. B. Smith Co., manufacturer of boilers and radiators, of Westfield, Mass., died at his home in that city on May 5. He was 58 years old, and had been connected with the Smith foundries since 1890.

HUDSON MAXIM, one of the world's most famous inventors, died at his home at Lake Hopatcong, N. J., on May 6. He was 74 years old. He was known particularly for his perfection of several kinds of high-power explosives and smokeless powders. He was a brother of Hiram Maxim, inventor of the Maxim gun.

CHARLES L. SHEPPY, chief engineer of the Pierce-Arrow Motor Car Co., and a prominent automotive engineer, died at Summerville, S. C., on May 2. Mr. Sheppy had been associated with the Pierce-Arrow company for almost thirty years. He was 56 years old. His home was in Buffalo, N. Y.

FREDERICK H. THATCHER, of Englewood, N. J., Eastern district sales manager for the Worthington Pump and Machinery Corporation, of New York, died suddenly in Cincinnati on May 3. Mr. Thatcher had been associated with the Worthington company for the past thirty days.

# Forthcoming Meetings

**American Gear Manufacturers Association.** Eleventh annual meeting, Hayes Hotel, Jackson, Mich., May 12 to 14. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

**American Society for Steel Treating.** Spring sectional meeting, Milwaukee, Wis., May 19 and 20. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

**American Society of Mechanical Engineers.** Semi-annual meeting, White Sulphur Springs, W. Va., May 23 to 26. C. E. Davies, secretary in charge of meetings, 29 West 39th St., New York.

**Associated Machine Tool Dealers.** Annual spring meeting at Granville, Ohio, May 25, 26 and 27. Tyler W. Carlisle, secretary, the Strong, Carlisle & Hammond Co., 1392 West Third St., Cleveland, Ohio.

**National Foreign Trade Council.** Fourteenth national foreign trade convention, Hotel Statler, Detroit, Mich., May 25, 26 and 27. O. K. Davis, secretary, India House, Hanover Square, New York.

**Society of Industrial Engineers.** Annual meeting, Hotel Stevens, Chicago, May 25, 26 and 27. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

**Society of Automotive Engineers.** Summer meeting, French Lick Springs, Ind., May 25 to 28. C. E. Heywood, manager of meetings department, 29 W. 39th St., New York City.

**American Foundrymen's Association.** Annual convention, Edgewater Beach, Chicago, June 6 to 10. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

**National Supply and Machinery Distributors' Association.** Twenty-second annual convention with the **Southern Supply and Machinery Dealers' Association,** and the **American Supply and Machinery Manufacturers' Association,** on board the steamship *Noronic.* Boat leaves Detroit, Mich., June 13 and returns there June 17. George A. Fernley, secretary, 505 Arch St., Phila-

**Exposition of Engineering Developments.** Under the auspices of the Association of Iron and Steel Electrical Engineers, in the Empire Bldg., Pittsburgh, June 13 to 18. John F. Kelly, general chairman, 705 Empire Bldg., Pittsburgh.

**American Society for Testing Materials.** Annual meeting at French Lick, Ind., June 20 to 24. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia.

**American Railway Tool Foremen's Association.** Fifteenth annual meeting, Hotel Sherman, Chicago, Aug. 31, Sept. 1 and 2. G. G. Macina, secretary, 11,402 Calumet Ave., Chicago.

**Machine Tool Exhibit.** Seventh annual machine tool exhibition under the auspices of the New Haven Section of the American Society of Mechanical Engineers, the Department of Mechanical Engineering of Sheffield Scientific School, Yale University, and the Chamber of Commerce of New Haven: At the Mason Laboratory, Yale University, Sept. 6 to 9. Harry R. Westcott, chairman of the exhibit committee, 400 Temple St., New Haven, Conn.

**American Society for Steel Treating.** Ninth annual convention and national steel exposition, Detroit, week of Sept. 19. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

**Machine Tool Builders' Exposition.** First annual machine tool exposition, conducted by the National Machine Tool Builders' Association, at the West Annex of the Public Auditorium, Cleveland, Ohio, Sept. 19 to 24. J. Wallace Carrel, vice-president and general manager, the Lodge & Shipley Machine Tool Co., Cincinnati, chairman of the exposition committee. Roberts Everett, manager of the exposition, 225 West 34th St., New York. Ernest F. DuBrul, general manager of the association, 826 Provident Bank Bldg., Cincinnati, Ohio.

# The Weekly Price Guide

### *Rise and Fall of the Market*

FINISHED steel, pig iron, scrap, coke, pipe and wire products are working gradually to lower price levels. In the last mentioned material, however, better demand is reported as having developed in the South. In the principal hot-rolled steel products, bars hold to $1.90 per 100 lb., Pittsburgh mill, while plates show little tendency to change from $1.80@$1.90 base. Structural shapes range from $1.80 to $1.90 per 100 lb., f.o.b. mill, with the minimum 10c. per 100 lb. under that of a month ago.

*(All prices as of May 6)*

## IRON AND STEEL

**PIG IRON**—Per gross ton, f.o.b.:

| | |
|---|---|
| CINCINNATI | |
| No. 2 Southern | $22.19 |
| Northern Basic | 20.89 |
| Southern Ohio No. 2 | 21.19 |
| NEW YORK—Tidewater Delivery | |
| Southern No. 2 (silicon 2.25@2.75) | 26.37 |
| BIRMINGHAM | |
| No. 2 Foundry | 18.50 |
| PHILADELPHIA | |
| Eastern Pa., No. 2x (silicon 2.25@2.75) | 22.76 |
| Virginia No. 2 | 27.17 |
| Basic | 21.76 |
| CHICAGO | |
| No. 2 Foundry local | 21.00 |
| No. 2 Foundry, Southern (silicon 2.25@2.75) | 23.55 |
| PITTSBURGH, including freight charge ($1.76) from Valley | |
| No. 2 Foundry | 20.26 |
| Basic | 19.76 |
| Bessemer | 21.26 |

**IRON MACHINERY CASTINGS**—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

| | |
|---|---|
| Detroit | 4.00@4.50 |
| Cleveland | 5.00@5.25 |
| Cincinnati | 5.00@5.50 |
| New York | 5.25@5.50 |
| Chicago | 4.75@5.25 |

**SHEETS**—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

| Blue Annealed | Pittsburgh Mill Base | Chicago | Cleveland | New York |
|---|---|---|---|---|
| No. 10 | 2.20@2.30 | 3.50 | 3.25 | 3.89 |
| No. 12 | 2.25@2.35 | 3.55 | 3.30 | 3.94 |
| No. 14 | 2.30@2.40 | 3.60 | 3.35 | 3.99 |
| No. 16 | 2.40@2.50 | 3.70 | 3.45 | 4.09 |
| Black | | | | |
| Nos. 18 to 20 | 2.50@2.60 | 3.75 | 3.25 | 4.00 |
| No. 22 | 2.65@2.75 | 3.90 | 3.40 | 4.15 |
| No. 24 | 2.70@2.80 | 3.95 | 3.45 | 4.20 |
| No. 26 | 2.80@2.90 | 4.05 | 3.55 | 4.30 |
| No. 28 | 2.95@3.05 | 4.20 | 4.70 | 4.45 |
| Galvanized | | | | |
| No. 10 | 2.95@3.00 | 4.10 | 3.95 | 4.25 |
| Nos. 12 to 14 | 3.05@3.10 | 4.20 | 4.05 | 4.35 |
| No. 16 | 3.15@3.20 | 4.30 | 4.15 | 4.45 |
| No. 18 | 3.30@3.35 | 4.45 | 4.30 | 4.60 |
| No. 20 | 3.45@3.50 | 4.60 | 4.45 | 4.75 |
| No. 22 | 3.50@3.55 | 4.65 | 4.50 | 4.80 |
| No. 24 | 3.65@3.70 | 4.80 | 4.65 | 4.95 |
| No. 26 | 3.85@3.90 | 5.05 | 4.90 | 5.20 |
| No. 28 | 4.10@4.15 | 5.30 | 5.15 | 5.45 |

**WELDED STEEL PIPE**—Warehouse discounts are as follows

| | New York Black | New York Galv. | Cleveland Black | Cleveland Galv. | Chicago Black | Chicago Galv |
|---|---|---|---|---|---|---|
| 1 to 3 in. steel butt welded | 53% | 39% | 55½% | 43½% | 54% | 41% |
| 2½ to 6 in. steel lap welded | 48% | 35% | 53½% | 40½% | 51% | 38% |

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

| Size, Inches | List Price per Foot | Diameter in Inches — External | Diameter in Inches — Internal | Thickness Inches |
|---|---|---|---|---|
| 1 | $0.17 | 1.315 | 1.049 | .133 |
| 1¼ | .23 | 1.66 | 1.38 | .14 |
| 1½ | .27½ | 1.9 | 1.61 | .145 |
| 2 | .37 | 2.375 | 2.067 | .154 |
| 2½ | .58½ | 2.875 | 2.469 | .203 |
| 3 | .76½ | 3.5 | 3.068 | .216 |
| 3½ | .92 | 4.0 | 3.548 | 226 |
| 4 | 1.09 | 4.5 | 4.026 | 237 |
| 4½ | 1.27 | 5.0 | 4.506 | 247 |
| 5 | 1.48 | 5.563 | 5.047 | 258 |
| 6 | 1.92 | 6.625 | 6.065 | 28 |

**SEAMLESS STEEL TUBING**—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft. or 100 lb.:

| Thickness — Decimal | B.w.g. and Fractions | Outside Diameter in Inches — ¼ | ⅜ | ½ | ⅝ | 1 | 1¼ | 1½ |
|---|---|---|---|---|---|---|---|---|
| | | Price per Foot | | | | | | |
| .035" | 20 | $0.15 | $0.16 | $0.17 | $0.18 | $0.19 | $0.21 | $0.23 |
| .049" | 18 | .17 | .18 | .19 | .20 | .21 | .23 | .25 |
| .065" | 16 | .19 | .20 | .21 | .22 | .23 | .25 | .27 |
| .083" | 14 | .20 | .22 | .23 | .24 | .25 | .27 | .29 |
| .095" | 13 | .21 | .23 | .25 | .26 | .27 | .29 | .31 |
| .109" | 12 | .22 | .24 | .26 | .27 | .28 | .30 | .32 |
| .120" or .125" | 11 | .23 | .25 | .27 | .28 | .29 | .31 | .33 |
| .134" | 10 | .24 | .26 | .28 | .29 | .30 | .32 | .34 |

**MISCELLANEOUS**—Warehouse prices in cents per pound in 100-lb. lots:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Spring steel, light* | 4.50 | .... | 4.65 |
| Spring steel, heavier | 4.00 | .... | 4.00 |
| Coppered Bessemer rods (base) | 6.05 | 6.00 | 6.20 |
| Hoop steel | 4.49 | 3.65 | 4.15 |
| Cold rolled strip steel | 6.25 | 6.35 | 6.25 |
| Floor plates | 5.25 | 5.30 | 5.00 |
| Cold drawn shafting or screw | 4.00 | 3.90 | 3.60 |
| Cold drawn flats, squares | 4.50 | 4.40 | 4.10 |
| Structural shapes (base) | 3.34 | 3.10 | 3.10 |
| Soft steel bars (base) | 3.24 | 3.00 | 3.00 |
| Soft steel bar shapes (base) | 3.24 | 3.00 | 3.00 |
| Soft steel bands (base) | 3.99 | 3.20 | 3.65 |
| Tank plates (base) | 3.34 | 3.20 | 3.10 |
| Bar iron (2.75 at mill) | 3.24 | 3.21 | 3.00 |
| Drill rod (from list) | 60% | 55% | 50% |

Electric welding wire, New York, ⅛, 8.35c.; ¼, 7.85c.; ⅝ to ½, 7.35c. per lb. *Flat, ⅛@¼-in. thick.

## METALS

Current Prices in Cents Per Pound

| | | | |
|---|---|---|---|
| Copper, electrolytic, up to carlots, New York | | | 14.25 |
| Tin, pigs, 5-ton lots, New York | | | 69.00 |
| Lead, pigs, up to carlots, E. St. Louis | 6.37½ | New York | 7.37½ |
| Zinc, slabs, up to carlots, E. St. Louis | 6.12½ | New York | 7.00 |

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Antimony, slabs, ton spot | 16.50 | ..... | 15.00 |
| Copper sheets, base | 21.75 | 21.75 | 21.75 |
| Copper wire, base | 18.62½ | 18.37½ | 18.50 |
| Copper bars, base | 21.37½ | 21.37½ | 21.37½ |
| Copper tubing, base | 23.75 | 23.25 | 23.75 |
| Brass sheets, high, base | 18.12½ | 18.12½ | 18.12½ |
| Brass tubing, high, base | 23.00 | 23.00 | 23.00 |
| Brass rods, high, base | 15.87½ | 15.87½ | 15.87½ |
| Brass wire, high, base | 18.62½ | 18.37½ | 18.62½ |

# Shop Materials and Supplies

## METALS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Aluminium ingots, 98 to 99%, 1 to 15 ton lots | 26.00 | 26@27 | 26.02 |
| Zinc sheets (casks) | 11.25 | 12.30 | 11.36 |
| Solder (½ and ½), (case lots) | 41.25 | 43.75 | 38½@42½ |

Babbitt metal, delivered, New York, cents per lb.:

| | |
|---|---|
| Genuine, highest grade | 86.00 |
| Commercial genuine, intermediate grade | 61.00 |
| Anti-friction metal, general service | 31.50 |
| No. 4 babbitt (f.o.b.) | 13.00 |

Nickel, f.o.b. refinery, cents per lb.:

| | | | |
|---|---|---|---|
| Ingots | 35.00 | Electrolytic | 39.00 |
| Shot | | | 36.00 |

**SPECIAL NICKEL AND ALLOYS**—Price in cents per lb., f.o.b. Huntington, W. Va.:

| | |
|---|---|
| Hot rolled nickel sheet (base) | 52.00 |
| Cold rolled nickel sheet (base) | 60.00 |
| Hot rolled rods, Grade "A" (base) | 50.00 |
| Cold drawn rods, Grade "A" (base) | 58.00 |

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

| | | | |
|---|---|---|---|
| Shot | 32.00 | Hot rolled rods (base) | 35.00 |
| Blocks | 32.00 | Cold drawn rods (base) | 43.00 |
| Cold rolled sheets (base) | 50.00 | Hot rolled sheets (base) | 42.00 |

**OLD METALS**—Dealers' purchasing prices in cents per pound:

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Crucible heavy copper | 11.50 @11.75 | 10.75 | 10.25 @10.75 |
| Copper, heavy, and wire | 10.75 @11.25 | 11.00 | 9.50@10.00 |
| Copper, light, and bottoms | 9.25 @ 9.75 | 9.50 | 8.50@ 9.00 |
| Heavy lead | 5.50 @ 5.75 | 6.25 | 5.50@ 6.00 |
| Tea lead | 4.12½@ 4.37½ | 4.25 | 4.25@ 4.75 |
| Brass, heavy, yellow | 7.25 @ 7.50 | 7.50 | 6.50@ 7.00 |
| Brass, heavy, red | 9.00 @ 9.25 | 9.50 | 8.75@ 9.25 |
| Brass, light | 5.50 @ 5.75 | 6.00 | 5.75@ 6.25 |
| No. 1 yellow rod turnings | 7.50 @ 7.75 | 7.50 | 6.75@ 7.25 |
| Zinc | 4.00 @ 4.25 | 4.00 | 3.00@ 3.50 |

**TIN PLATES**—Charcoal—Bright—Per box.

| | | New York | Cleveland | Chicago |
|---|---|---|---|---|
| "AAA" Grade: | | | | |
| IC, | 14x20 | $12.10 | $11.95 | $11.50 |
| "A" Grade: | | | | |
| IC, | 14x20 | 9.70 | 9.90 | 9.50 |
| | Coke Plates—Primes—Per box | | | |
| 100-lb., | 14x20 | 6.45 | 6.10 | 7.00 |
| | Terne Plates—Small lots, 8-lb. Coating—Per box | | | |
| IC, | 14x20 | 7.75@8.00 | 7.00 | 7.50 |

## MISCELLANEOUS

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Cotton waste, white, per lb. | $0.10@0.13½ | $0.16 | $0.15@0.20 |
| Cotton waste, colored, per lb. | .09@ .13 | .12 | .12@.17 |
| Wiping cloths, washed white, per lb | .15½ | 36.00 per M | .15 |
| Sal soda, per lb | .02½ | .02 | .02¾ |
| Roll sulphur, per lb | .02½ | .03½ | .04 |
| Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots | .87½ | .93 | .87 |
| Lard cutting oil, 25% lard, in 5 gal. cans, per gal. | .55 | .50 | .50 |
| Machine oil, medium-bodied (55 gal. metal bbl.), per gal. | .33 | .35 | .29 |
| Belting—Present discounts from list in fair quantities (½ doz. rolls). | | | |
| Leather—List price, 24c. per lin. ft per inch of width for single ply. | | | |
| Medium grade | 40–5% | 40–5% | 40–5% |
| Heavy grade | 30–10% | 30–10% | 30–10% |
| Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft. | | | |
| First grade | 50% | 50–10% | 50% |
| Second grade | 50–10% | 60–5% | 50–10% |

### *Comparative Warehouse Prices*

| New York | Unit | Current Price | Four Weeks Ago | One Year Ago |
|---|---|---|---|---|
| Soft steel bars | per lb. | $0.0324 | $0.0324 | $0.0324 |
| Cold drawn shafting | per lb. | .04 | .04 | .04 |
| Brass rods | per lb. | .1587½ | .1612½ | .1662½ |
| Solder (½ and ½) | per lb. | .415 | .42 | .395 |
| Cotton waste, white | per lb. | .10@13½ | .10@.13½ | .13@.17½ |
| Emery disks, cloth, No. 1, 6 in. dia. | per 100 | 3.10 | 3.10 | 3.55 |
| Lard cutting oil | per gal. | .55 | .55 | .55 |
| Machine oil | per gal. | .33 | .33 | .35 |
| Belting, leather, medium | off list | 40–5% | 40–5% | 40–5% |
| Machine bolts, up to 1x30 in., full kegs. | off list | 50%* | 50%* | 40% |

*New list April 1, 1927.

## MISCELLANEOUS—Continued

| | New York | Cleveland | Chicago |
|---|---|---|---|
| Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets: | | | |
| *Flint paper | $5.13 | $4.95 | $5.13 |
| *Emery paper | 10.71 | 9.15 | 10.71 |
| *Emery cloth | 27.84 | 27.85 | 27.84 |
| Emery disks, 6 in. dia., No. 1 grade, per 100: | | | |
| Paper | 1.29 | 1.27 | 1.32 |
| Cloth | 3.10 | 3.05 | 3.05 |
| Fire clay, per 100 lb. bag | | .75 | .75 |
| Coke, prompt furnace, per net ton | | Connellsville, | 2.75@3.00 |
| Coke, prompt foundry, per net ton | | Connellsville, | 4.00@4.50 |
| White lead, dry or in oil, | 100 lb. kegs | New York, | 15.25 |
| Red lead, dry, | 100 lb. kegs | New York, | 15.25 |
| Red lead, in oil, | 100 lb. kegs | New York, | 16.75 |

*4½ reams and under.

## SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

| | Broken Kegs or Cases | Full Kegs or Cases |
|---|---|---|
| Machine bolts, square heads and nuts: | | |
| Up to ¾ x 6-in. | 50% | 50–10% |
| Larger up to 1 x 30-in. | 45% | 50% |
| 1¼ and 1½ in. dia. | 30% | 35% |
| Carriage bolts: | | |
| Up to ½ x 6-in. | 50–10% | ..... |
| Larger sizes | 50% | ..... |
| Coach and lag screws: | | |
| Up to ½ x 6-in. | 50–10% | ..... |
| Larger sizes | 50% | ..... |
| Tap bolts, hexagonal heads | 45% | ..... |
| Nuts: | | |
| Hot pressed, square and hexagonal, blank or tapped | 45% | 50–10% |
| Cold punched, square and hexagonal, blank or tapped | 45% | 50–10% |
| Semi-finished, hexagonal, tapped, in packages | 40% | ..... |
| Case hardened, hexagonal, tapped, in packages | 30% | ..... |
| Washers: Deduct from list, per 100 lb. | $1.50 | $3.50 |
| Rivets, button and cone head: | | |
| Small, including 7/16-in. dia. | ..... | 50–10% |
| Large (base) per 100 lb. | $6.50 | $5.00 |

EXTRA per 100 lb. on rivets, for ½-in. dia., 35c.; ⅝-in., 15c.; 1-in., 5c.; lengths 1-in. and shorter, 25c.; longer than 1-in. up to and including 1 ½-in., 15c. longer than 5-in., 25c.; standard countersunk head, 25c.

# Machine Requirements and Industrial Construction

## Equipment Wanted

**Ala., Anniston** — Kelly Car & Foundry Co.—bolt trimming machine.

**Calif., Riverside**—Cresmer Mfg. Co., 170 East 8th St.—equipment for the manufacture of ladders, sashes, etc., for mill to be rebuilt to replace fire loss. Estimated cost $100,000.

**Kan., Kansas City** — Gould Castings Corp., c/o A. R. Gould, 5256 Vernon Ave., St. Louis—complete equipment to manufacture steel, grey iron, brass, bronze and other castings, including electric furnace, etc., for proposed 1 story, 150 x 375 ft. foundry.

**Mass., Littleton**—G. M. & A. W. Hartwell—circular resaw and double surfacer.

**Mass., Peabody**—P. O. Box 241—2½ to 6 in. power-driven pipe fitting machine.

**Mass., Salem**—R. Rogers, 2 Holly St.—miscellaneous tools and equipment for proposed repair and service garage. Estimated cost $50,000.

**N. H., Nashua** — City, P. G. Sargent, Mayor—miscellaneous tools and equipment for proposed machine shop and garage. Estimated cost $50,000.

**O., Bexley**—Bd. of Education, J. L. Henney, 2442 Brentwood Ave., Purch. Agt.—grinder, bench circular saw, land planer, joiner and 24 in. motor driven lathe.

**O., Cleveland**—Bd. of Education, F. G. Hogen, Dir.—machinery and equipment for shops (about Dec. 1) for proposed 3 story, 160 x 292 ft. high school.

**O., Cleveland**—Colonial Iron Works, 881 East 67th St.—three 3 ton, 2 motor electric cranes.

**Tex., San Angelo**—H. O. Lown, Texarkana—additional machinery and equipment for recently acquired plant of San Angelo Foundry & Machine Co. at San Angelo including machine forging plant, grey iron foundry, pattern shops, etc.

**Alta., Brant**—F. A. Migedley — lathe, medium size, engine screw cutting machine, 4 to 6 ft. bed with counter shaft.

**B. C., Vancouver**—Vancouver Machinery Depot Ltd., 1155 6th Ave., W. T. Fraser, Purch. Agt.—lathes, various sizes, traveling crane, etc.

**Ont., London**—Mitchell Cooperage Plant, 585 Bathurst St.—complete machinery and equipment for plant to replace fire loss. Estimated cost $30,000.

**Ont., Walkerville**—General Motors Co., H. A. Brown, Oshawa, Ch. Engr.—special machinery and equipment for the manufacture of Chevrolet motor axles for proposed plant. Estimated cost $100,000.

## Opportunities for Future Business

**Calif., Long Beach** — General Motors Truck Co., D. B. Jacques, Br. Mgr., awarded contract for the construction of a 1 and 2 story 200 x 300 ft. garage and repair shop at Alamenda and Washington Sts.

**Calif., Los Angeles**—H. A. Meisel, 650 South Spring St., manufacturer of furniture, awarded contract for the construction of a 1 story, 244 x 248 ft. factory on East 59th St. Estimated cost $75,000.

**Calif., Los Angeles**—Packard Motor Car Co., E. C. Anthony, Inc., awarded contract for the construction of a 4 story, 150 x 160 ft. addition to garage at 10th and Hope Sts. Estimated cost $250,000.

**Calif., Los Angeles**—Truscon Steel Co., Albert Ext., Youngstown, O., manufacturers of steel products, plans the construction of a plant at Slauson, Eastern and Atlantic Aves., here. Estimated cost $250,000. Private plans. Noted Apr. 5.

**Calif., Richmond** — Enterprise Foundry Co., 2902 19th St., San Francisco, plans the construction of a foundry at Richmond Inner Harbor here. Estimated cost $40,000.

**Calif., San Jose**—Hellwig Iron Works, 67 Almaden Ave., awarded contract for the construction of a machine shop on Vine St. Noted Apr. 21.

**Calif., South San Francisco**—E. D. Hargrave, Miller Ave. and M. L. Spangler, Eucalyptus Ave., had plans prepared for the construction of a wire works. Estimated cost $50,000. Private plans.

**Colo., Pueblo**—Colorado Fuel & Iron Co., E. W. Weitzel, V. Pres. and Gen. Mgr., had plans prepared for rebuilding and modernizing open hearth plant. Estimated cost $1,000,000.

**Conn., Bridgeport** — Bridgeport Metal Goods Co., Cherry St., is receiving bids for the construction of a 2 story, 60 x 240 ft. plant. Estimated cost $100,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Archt. Noted Apr. 21.

**Ill., Chicago**—F. H. Hill & Co., 946 West Washington Blvd., manufacturers of coffins, awarded contract for the construction of a 1 story factory. Estimated cost $115,000.

**Ill., Chicago**—Holton Seelye Co., 140 South Dearborn St., plans the construction of a 6 story, 100 x 150 ft. garage at 701-727 Plymouth Ct. Estimated cost $100,000. L. Russell, 140 South Dearborn St., Archt.

**Ill., Chicago**—Interstate Iron & Steel Co., 118th St. and Calumet Ave., plans the construction of a 129 x 145 ft. furnace building at 11081-11919 Burley Ave. Estimated cost $120,000. F. Hoffman, 200 South La Salle St., Archt.

**Md., Baltimore**—The Anchor Post Fence Co., 9 East 38th St., New York, N. Y., awarded contract for the construction of a plant for the manufacture of wire fences, gates and railings, etc. here.

**Mass., Brookline** (Boston P. O.)—H. M. Rambach, 18 Tremont St., Boston, awarded contract for the construction of a 1 story machine shop at Harvard St. and Alton Pl. Noted Apr. 21.

**Mass., Holyoke**—Worthington Pump & Machinery Corp., 37 Appleton St., awarded contract for the construction of addition to machine shop. Noted Apr. 14.

**Mass., Revere** (Boston P. O.)—Suburban Gas & Electric Co., 150 Beach St., is receiving bids for the construction of a 1 story, 55 x 105 ft. garage and repair shop. Estimated cost $50,000. Private plans.

**Mass., South Boston** (Boston P. O.) — National Metal & Rubber Co., 27 Stillings St., is having preliminary plans prepared for the construction of a 1 story addition to plant. Estimated cost $40,000. Private plans.

**Mass., Worcester**—Boston & Albany R.R., South Station, Boston, awarded contract for the construction of a 2 story, 45 x 115 ft. addition to machine shop on Grafton St. here. Noted Feb. 17.

**Mich., Detroit**—Peninsular Stove Works, 1417 West Fort St., awarded contract for the construction of a 1 and 2 story plant including garage, etc. on Burton Rd. Noted Mar. 17.

**Mich., Saginaw** — City, G. S. Crabbe, Comr. of Light, Water & Sewers, will receive bids until May 24, for the construction of shops, etc. H. H. Eymer, Engr.

**Mo., St. Louis** — William King & Associates, 117 South Broadway, will receive bids until May 15 for the construction of a 6 story garage at 13th and St. Charles Sts. Estimated cost $500,000. W. J. Knight & Co., Wainwright Bldg., Archt. and Engr.

**Mo., St. Louis**—Wells Motor Co., 3008 North Grand Blvd., will receive bids until May 14 for the construction of a 1 and 2 story, 100 x 150 ft. garage and sales and service station at 3000 North Spring St. Estimated cost $60,000. G. H. Hargitt, 5332 Vernon Ave., Archt.

**N. J., Irvington**—E. Polter & Co., 1168 South Grove St., manufacturers of bag frames, awarded contract for the construction of a 2 story, 65 x 100 ft. factory. Estimated cost $40,000. Noted Apr. 28.

**N. Y., New York**—Reclamation & Building Corp., A. Brisbane, Pres., 238 William St., awarded contract for the construction of a 4 story addition to garage at 5-19 East 102nd St. Estimated cost $150,000.

**O., Cleveland** — The American Register Co., 3608 Payne Ave., manufacturers of furnace registers, awarded contract for the construction of a 3 story, 43 x 47 ft. addition to factory. Estimated cost $40,000.

**O., Cleveland** — Grabler Mfg. Co., L. Rosenfeld, Pres., 6565 Broadway, manufacturers of metal specialties, awarded contract for the construction of a 1 story addition to core foundry. Estimated cost $40,000. Noted Dec. 30.

**O., Cleveland**—The Ohio Truck Body & Wagon Co., M. T. Gardner, Gen. Mgr., 3291 East 65th St., awarded contract for the construction of a 1 story, 68 x 150 ft. factory. Estimated cost $50,000.

**O., Cleveland**—The Smith Incubator Co., W. A. Smith, Treas., 1920 West 77th St., is receiving bids for the construction of a 1 and 2 story, 200 x 270 and 20 x 200 ft. factory, on Elmwood Ave. Estimated cost $150,000. J. M. Walsh, c/o owner, Archt. Noted Apr. 14.

**O., Portsmouth** — R. Searles is having plans prepared for the construction of a 2 story garage and repair shop on Ninth St. Estimated cost $35,000.

**Pa., Philadelphia**—Felt Bros., Packard Bldg., will soon award contract for the construction of a 1 story, 124 x 169 and 112 x 170 ft. sales and service station at Germantown Ave. and Bethlehem Pike. Ballinger Co., 12th and Chestnut Sts., Archt.

**Pa., Philadelphia**—R. H. & J. J. Greenberg, Morris Bldg., awarded contract for the construction of a 4 story, 69 x 240 ft. sales and service station at 1515 North Broad St. Estimated cost $400,000. Harper & Harper, 720 North Broad St., lessees.

**Wis., Du Pere**—The Du Pere Motor Co., George and Superior Sts., is having plans prepared for the construction of a 2 story, 50 x 120 ft. shop and service station. Estimated cost $40,000. N. R. Safford, Archt. Noted Apr. 28.

**Wis., Richland Center** — Southwestern Veneer & Box Co., A. C. Burnham, Pres., will build a 1 story, 100 x 140 ft. factory. Estimated cost $40,000. Private plans. Noted Apr. 14.

**Wis., Sturgeon Bay**—Severson & Konard, John and Garland Sts., is receiving bids for the construction of a 1 story, 80 x 100 ft. shop and service station. Estimated cost $40,000. Private plans. Noted May 5.

**Wis., West Allis**—Le Roi Co., awarded contract for the construction of a pattern storage building, etc. Noted Apr. 21.

**B. C., New Westminster**—International Wood Products Co. Ltd., 4th Ave., will build a saw mill. Estimated cost $200,000. Private plans.

**Ont., Brockville**—E. J. Phillips Electrical Works, 579 De Gaspé St., Montreal, Que., will soon receive bids for the construction of a 1 story, 75 x 150 ft. wire manufacturing plant here. Estimated cost $40,000. J. M. Millar, 364 Dorchester St., Brockville, Ont., Archt. Noted Mar. 10.

**Ont., Tilbury**—Canadian Auto Top & Body Co., L. Odette, Mgr., will build an addition to plant. Estimated cost $60,000.

**Ont., Toronto**—Toronto Transportation Comn., Yonge & Front Sts., plans the construction of a machine shop, etc., on Esplanade St. Estimated cost $50,000. D. W. Harvey, Engr.